Quantum®

DLT2000/DLT2500/DLT2700 Cartridge Tape Subsystem

Product Manual

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The following FCC Notice applies to the DLT2000 drive:

FCC NOTICE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in residential installation. Any changes or modifications made to this equipment may void the user's authority to operate this equipment.

This equipment generates, uses, and radiates radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by tuning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician for help. The shielded interconnect cable shipped with the unit should not be altered or modified in any way. The unit shipped without a shielded interconnect cable must use a shielded interconnect cable.

The user may find the following booklet prepared by the Federal Communications Commission helpful: How to Identify and Resolve Radio-TV Interference Problems. This booklet is available from the U.S. Government Printing Office, Washington D.C., 20402. Stock No. 004-00398-5.

All external I/O cables connecting to this unit need to be shielded. See the User Manual or installation instructions for more options.

This digital apparatus does not exceed the Class B limits for radio noise emissions set out in the radio interference regulations of the Canadian Department of Communications.

This equipment is in the 2nd Class Category (information equipment to be used in a residential area or an adjacent area thereto) and conforms to the standards set by the Voluntary Control Council For Interference by Data Processing Equipment and Electronic Office Machines aimed at preventing radio interference in such residential area.

This equipment meets or exceeds requirements for safety in the U.S. (UL 1950), Canada (CSA C22.2 N0. 950) and Europe (EN60950/IEC 950) requirements, and is certified to bear the GS mark by TUV.

The following FCC Notice applies to DLT2500 and DLT2700 mini-library:

FCC NOTICE: This equipment has been tested and found to comply with the limits for a Class A device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Any changes or modifications made to this equipment may void the user's authority to operate this equipment. Operation of this equipment in a residential area may cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference. The shielded interconnect cable shipped with the unit should not be altered or modified in any way. The unit shipped without a shielded cable must use a shielded interconnect cable.

Warning! This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Achtung! Dieses ist ein Gerat der Funkstorgenzwertklasse A. In Wohnbereicghen konnen bei Betrieb dieses Gerates Runfunkstorungen auftreten, in welchen Fallen der Benutzer fur entsprechende GengenmaBnahmen verantwortlich ist.

Attention! Ceci est un produit de Classe A. Dans un environment domestique, ce produit risque de creer des interferences radioelectriques, il appartiendra alors a l'utilisateur de prendre les mesures specifiques appropriees.

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REVISION HISTORY

This Revision History provides a concise publication record of this manual. It lists the manual revision levels, release dates, and reasons for the revisions.

Manual No. - Rev Level	Date	Summary of Changes
81-109132-01	April 14, 1995	Original issue
81-109132-02	August 18, 1995	Specifications and illustrations were upgraded.
		DLT2500 Mini-library section add.
81-109132-03	January 19, 1996	Caution added for unloading a tape cartridge.
		AC Power Cord spec's added.
		FCC Statement upgraded.
		Upgraded Chapters 1 to 8 and appendix A.

Preface

To the Reader:

QUANTUM makes every effort to ensure the accuracy of information. However, some errors may have been introduced inadvertently; they will be corrected in the next release. QUANTUM recognizes that some users may require additional content. We welcome your feedback and your suggestions for enhancements and we will evaluate your input for a future release. Please send your comments to:

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Purpose of This Manual

This manual is isssued for the DLT2000 Cartridge Tape drive, and DLT2500 and DLT2700 Cartridge Tape Subsystems. The manual describes operating procedures, code update, and SCSI protocol features.

All care is taken to ensure accuracy. However, some of the parameters, drawings, and specifications being under constant review, and enhancement, may change.

Who Should Use This Manual

This manual is written for the subsystem or system integrator and users of the DLT2000/DLT2500/DLT2700 Cartridge Tape Subsystem.

Structure of This Manual

Chapter 1, Overview and Features of the DLT2000/DLT2500/DLT2700 Product, gives a product overview and lists the product features of the DLT2000/DLT2700 tape subsystem.

Chapter 2, Installing and Configuring the DLT2000 Tabletop Drive, describes installing and configuring the DLT2000 tabletop tape drive.

Chapter 3, Configuring and Operating the DLT2000 Tape Drive, includes selecting density, configuration, and other operation information for the tape drive, such as front panel indicators and controls, Power-on Self-test, the tape cartridge write-protect switch, loading a cartridge, using the cleaning tape, unloading a cartridge, and preserving cartridges.

Chapter 4, Configuring and Operating the DLT2500 Mini-Library, includes configuration, selecting density, and other operation information for the loader, such as the power-on process, the loader Mode Select key, the operator control panel, and functions of the Slot Select, Load/Unload, and Eject buttons.

Chapter 5, Configuring and Operating the DLT2700 Mini-Library, includes configuration, selecting density, and other operation information for the loader, such as the power-on process, the loader Mode Select key, the operator control panel, and functions of the Slot Select, Load/Unload, and Eject buttons.

Chapter 6, Troubleshooting Guide for the DLT2500/DLT2700 Mini-Library, gives instructions on how to clear failures and describes the necessary conditions to ensure the loader OCP pushbuttons operate effectively.

Chapter 7, Firmware Update (From Tape), provides an overview on updating the firmware, describes how to create a firmware update tape, and tells how to update the firmware.

Chapter 8, DLT2000 SCSI Interface, details the SCSI protocol features of the DLT2000 tape subsystem.

Appendix A, Technical Specifications, gives product specifications including physical dimensions, performance specifications, power requirements, environmental specifications, vibration and shock requirements, electromagnetic interference susceptibility, regulatory requirements, and reliability factors.

Appendix B, Definition of Vendor Unique Sense Data Information, describes the internal status codes for the DLT2000/DLT2500/DLT2700 product.

Appendix C, Sense Key Information, lists the sense key information for the DLT2000/DLT2500/DLT2700 product.

1

Overview and Features of the DLT2000/DLT2500/DLT2700 Product

1.1 In This Chapter

Chapter 1 includes the following main topics and sections:

Topic	Section
Product Overview	1.2
Fast Data Transfer Rate	1.3
High-Capacity	1.4
Compaction	1.5
Strong Media	1.6
Compatibility	1.7
Firmware Update Capability	1.8
Embedded Diagnostics	1.9

1.2 Product Overview

The DLT2000/DLT2500/DLT2700 is a high-performance, high-capacity, streaming cartridge tape product designed for use on midrange and high-end computing systems. Using data compression and compaction, the DLT2000 drive features a formatted capacity of 30 GB and a sustained user data transfer rate of 2.5 MB/s.

The DLT2000 is a 5.25 inch form factor, half-inch tape drive. The design includes a dual-channel read/write head, Lempel-Ziv (LZ) high-efficiency data compression, and tape mark directory to maximize data throughput and minimize data access time.

The DLT2500 is a tape mini-library that performs automatic tape operations. The DLT2500 includes the tape drive and a 5-cartridge SCSI-2 medium changer device (loader). The mini-library provides unattended backup of 100 GB in less than 16 hours or up to 50 GB in an 8-hour shift in a compressed mode.

The DLT2700 is a tape mini-library that performs automatic tape operations. The DLT2700 includes the tape drive and a 7-cartridge SCSI-2 medium changer device (loader). The mini-library provides unattended backup of 140 GB in less than 16 hours or up to 70 GB in an 8-hour shift in a compressed mode.

The drive and mini-libraries are available in a rackmountable form factor. Also, the DLT2000, DLT2500 and DLT2700 are available with either single-ended or differential, fast driver/receivers.

1.3 Fast Data Transfer Rate

Used for unattended backups or archiving, the DLT2000/DLT2500/DLT2700 allows the user to back up a higher data capacity at a high speed. The DLT2000/DLT2500/DLT2700, when operating in a non-compressed mode, has a maximum transfer rate of 1.25 MB/s. When operating in the compressed mode, the maximum transfer rate is 2.5 MB/s write and 3.0 MB/s read.

1.4 High-Capacity

The amount of data the user can store on a tape CompacTape III cartridge can be up to 10.0 GB native capacity or 20.0 GB compressed, depending on whether you select compression mode. Built-in data compression increases cartridge capacity and drive transfer rate 2 to 2.5 times. Compression can be selected on the loader or drive front panel or from the host by using the SCSI MODE SELECT command.

1.5 Compaction

The compaction feature of the DLT2000 helps you to store data efficiently. A read/write data cache of 2.0 MB allows working space for the compaction, enabling maximum use of available tape space.

1.6 Durable Media

The CompacTape III tape media can endure 500,000 passes and has a shelf life of 30 years, which provides superior media durability and data reliability.

1.7 Compatibility

Quantum is committed to maintaining compatibility within the DLT family of tape drives. DLT2000/DLT2500/DLT2700 tape products are the fourth generation of tape products, started with the DLT260 and DLT600 drives.

The DLT2000/DLT2500/DLT2700 complies with the ANSI standard for SCSI-2. The tape media format follows ECMA approved and ANSI proposed standards.

The user can select tape density for the CompacTape III cartridge on the loader or drive front panel or by using the SCSI MODE SELECT command. The DLT2000/DLT2500/DLT2700 can write 2.6, 6.0, and 10.0 GB tape formats for 100% interchange compatibility with earlier DLT drives using the CompacTape III cartridge. On a write from BOT, the DLT2000/DLT2500/DLT2700 reformats the CompacTape III cartridge recorded at 2.6, 6.0, or 10.0 GB format to the new specified format using the new specified format.

1.8 Firmware Update Capability

The DLT2000 includes Flash EEPROM technology that allows easy on-site installation of microcode updates from tape.

1.9 Embedded Diagnostics

The DLT2000 has embedded diagnostic software that tells you when head cleaning is required, and indicates diagnostic results, and drive operating status. The drive has embedded data logging of errors for failure analysis.

Chapter 2

Installing and Configuring the DLT2000 Tabletop Drive

2.1 In This Chapter

Chapter 2 includes the following main topics and sections:

Topic	Section
Prepare for the Installation	2.2
Install the Subsystem	2.3
Configure the DLT2000 Tabletop	2.4
Connect the Cables	2.5
Test the Installation	2.6
DLT2000 Troubleshooting Chart	2.7

2.2 Prepare for the Installation

This section describes how to prepare for the installation of the DLT2000 cartridge tape subsystem including:

Topic	Section
Before You Start	2.2.1
Installation Setup	2.2.2
Site Setup	2.2.3
Site Guidelines	2.2.4

2.2.1 Before You Start

Installing the DLT2000 tabletop cartridge tape subsystem requires no special tools. If you need to change the switchpack settings on the rear panel, you will need a pen.

If you have problems during the installation, see Table 2-4 for troubleshooting.

2.2.2 Installation Setup

The steps for installation setup are:

Step	Action
1	Unpack and check your shipment.
2	Choose a site for the DLT2000 tabletop subsystem.
3	Power off the system on which the DLT2000 tabletop subsystem is to be installed.

2.2.3 Site Setup

Place the DLT2000 on a flat, sturdy, level area such as a desk or tabletop.

2.2.4 Site Guidelines

Be sure to follow these guidelines for your DLT2000:

- The DLT2000 is designed to operate in harsh environments. However, use care in placing the drive in an environment that is free of dust and humidity.

Figure 2-1 shows the DLT2000.

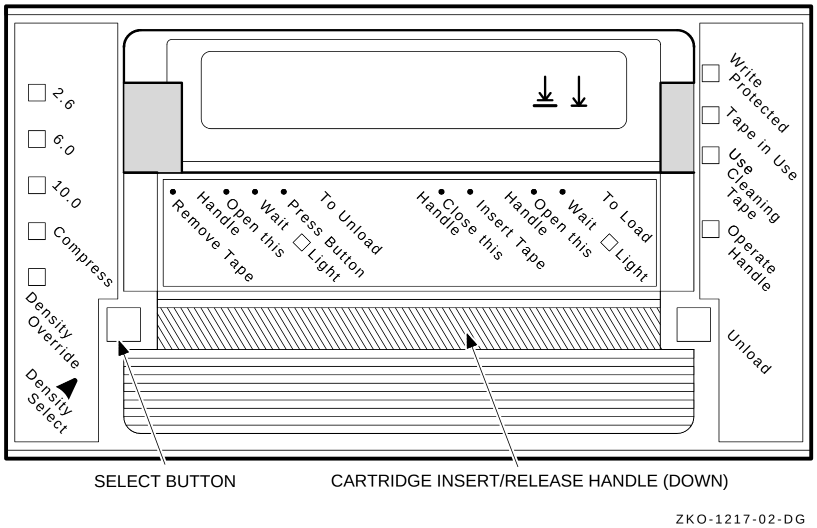


Figure 2-1 *Drive Front Panel*

2.3 Install the Subsystem

To install the DLT2000:

Step	Action	
1	Note the DLT2000 factory settings.	
2	Review Section 2.4.1.	
3	Configure the DLT2000 for use on your system:	
	If you need to …	**See section …**
	Disable parity checking	2.4.2
	Change the SCSI ID	2.4.3
4	Connect the cables.	

2.4 Configure the DLT2000 Tabletop

This section describes how to configure the DLT2000 including:

Topic	Section
Configuration Guidelines	2.4.1
Disable Parity Checking	2.4.2
Changing the SCSI ID	2.4.3

The DLT2000 is factory set to SCSI ID 5, unless otherwise specified. The drive is factory set for parity generation and checking is enabled.

2.4.1 Configuration Guidelines

All system uses the SCSI ID to identify, or address, the DLT2000. Follow these guidelines when configuring the DLT2000 for use on your system:

If you are installing the DLT2000 as …	Then …
The only SCSI device on the bus or one of multiple SCSI devices on the bus	Be sure to use a SCSI ID that is unique from any other device or system ID on the SCSI bus.
The last or only device on the SCSI bus	You must terminate the bus by installing a terminator on the drive.

2.4.2 Disable Parity Checking

To disable parity, see your service representative.

2.4.3 Changing the SCSI ID

To change the SCSI ID use the pushbutton switch on the rear of the drive. Press the switch button(s) above or below the number display (0-7) to set the desired SCSI ID. Press the top button to increase the number or press the bottom button to decrease the number.

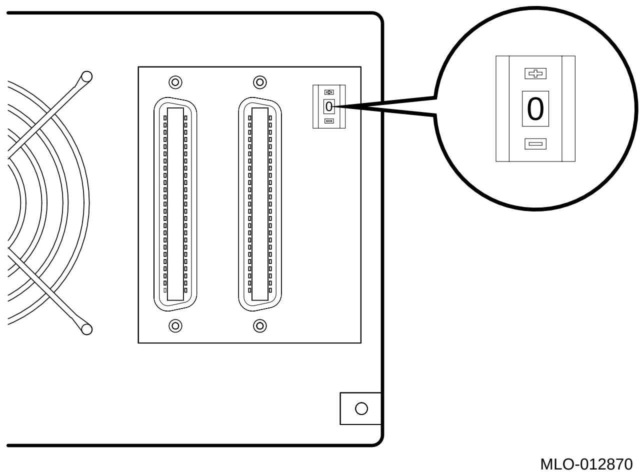


Figure 2-2 *Changing the SCSI ID via the Pushbutton Switch*

2.5 Connect the Cables

Section 2.5 includes the following topics:

Topic	**Section**
Examine the DLT2000 Rear Panel	2.5.1
Connect the SCSI Signal Cable	2.5.2
Terminate the SCSI Bus	2.5.3
Connect the Power Cord	2.5.4

2.5.1 Examine the DLT2000 Rear Panel

Examine the components on the DLT2000 rear panel to complete the physical installation (Figure 2-3).

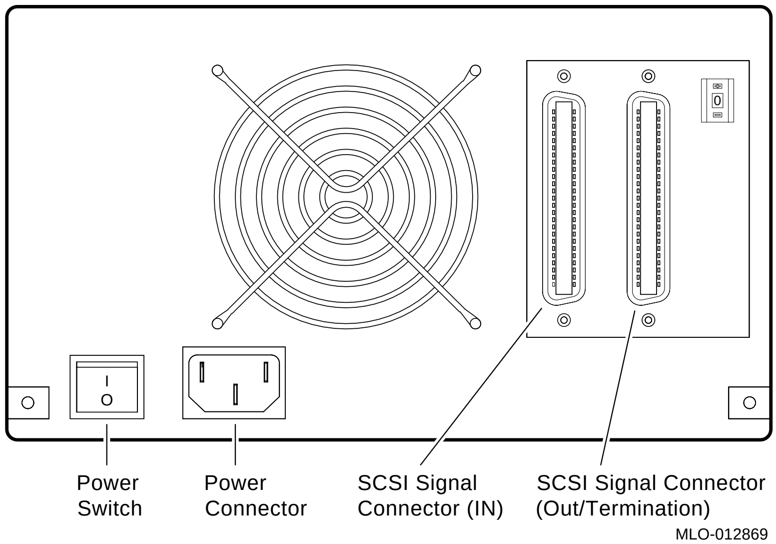


Figure 2-3 *Rear Panel Components*

2.5.2 Connect the SCSI Signal Cable

To connect the SCSI signal cable:

1. Connect one end of the SCSI cable to the leftmost SCSI signal connector on the DLT2000 rear panel.
2. Snap the wire cable clamps into place to secure the cable.
3. Connect the other end of the SCSI signal cable to the SCSI connector on your system or, for daisy-chained configurations, to another SCSI device.

See your system documentation for system SCSI connections.

2.5.3 Terminate the SCSI Bus

Note

The SCSI bus must be terminated at both ends and at least one device must supply terminator power.

Table 2-1 indicates when and where to add a terminator.

Table 2-1 *Adding a Terminator*

If the DLT2000 is …	Then …
The last or only device on the bus and you are going to terminate the cables externally	1. Connect the SCSI terminator to one of the SCSI signal connectors on the DLT2000 rear panel. 2. Snap the wire cable clamps into place or tighten screws (whichever is supplied) to secure the terminator.
Not the last or only device on the SCSI bus	Be sure to install the terminator at the end of the bus.

The DLT2000 to supply TRM PWR on the bus by adding a jumper to the pins labeled TRM PWR on the controller module.

2.5.4 Connect the Power Cord

To connect the power cord:

1. Ensure the DLT2000 power switch is set to 0.
2. Connect the power cord to the DLT2000 power connector. Make sure the connector is fully seated.
3. Connect the other end of the power cord to a nearby ac outlet.

2.6 Test the Installation

Section 2.6 includes the following topics:

Topic	Section
Run the Power-On Self-Test (POST)	2.6.1
What to Do after POST	2.6.2

2.6.1 Run POST

To test the installation for the DLT2000 by running POST:

1. Turn on the system power.
2. Set the power switch on the DLT2000 rear panel to on. POST runs automatically.
3. Observe the indicators on the DLT2000 front panel. Ensure the indicator sequence of events is the same as in Table 2-2 . Events on the right and left sides happen at the same time.

Table 2-2 *POST*

Event	Action
1	The lights on the right front panel turn on sequentially from top to bottom. All lights stay on for a few seconds.
2	All lights on the left front panel turn on at the same time for about three seconds and then turn off.
3	The green Operate Handle, the orange Write Protected, and the Yellow Use Cleaning Tape lights turn off. The yellow Tape in Use light blinks while the tape drive initializes.
4	After initialization, if no cartridge is loaded, the yellow Tape In Use light turns off, the green Operate Handle light turns on, the handle unlatches, and the beeper sounds.

For more information on what happens after initialization when a cartridge is present, but the handle is down; or a cartridge is present, but the handle is up (not recommended), see Section 3.5.4 in Chapter 3.

POST completes in about 13 seconds and the drive responds normally to all commands. However, it might take longer for the media to become ready. After a bus reset, the tape drive responds within a bus selection timeout period.

2.6.2 What to Do after POST

Table 2-3 *After POST*

If …	Then …
All the events in Table 2-2 took place	POST succeeded. Bring up the system and run the optional system tests. See Chapter 3 for operating the drive and selecting density.
All left- or right-side lights on the DLT2000 front panel blink only	POST failed. See Table 2-4.

2.7 DLT2000 Troubleshooting Chart

If the DLT2000 fails during POST or operation, use Table 2-4 to determine the problem and the action to take.

Table 2-4 *DLT2000 Troubleshooting Chart*

If. . .	Then . . .	You should. . .
Your system does not recognize the DLT2000	Your system might not be configured to see the SCSI ID	Configure your system to see the ID.
	The SCSI ID might not be unique	Change the SCSI ID and reconfigure the system. New ID effective at next power-on.
	The parameters for your SCSI adapter might be incorrect	Check your SCSI adapter installation.
	The SCSI signal cable might be loose	Make sure the connector on each end of the cable is fully seated.
	The SCSI terminator might not be present or might be loose	Install the terminator; make sure the terminator is fully seated.
	The SCSI bus might not be correctly terminated	If the DLT2000 is the last or only device on the bus, make sure the terminator is installed on the DLT2000. If the DLT2000 is not the last or only device on the bus, check the cable connections and make sure the terminator is installed at the end of the bus.
	The SCSI terminator might not be at the end of the bus, or more than two terminators might be present	Be sure to install a terminator at each end of the bus. One terminator is usually installed at the system.

Table 2-4 *DLT2000 Troubleshooting Chart (cont'd)*

If. . .	Then . . .	You should. . .
Your system does not recognize the DLT2000	1. The SCSI bus might be too long. 2. Too many devices might be on the bus.	1. Limit the bus length to the ANSI SCSI standard of 6 meters (19 feet) for single ended (SE) or 25 meters (82 feet) for differential 2. Limit the number of devices on the bus (including the system) to eight Check your system configuration rules.
The DLT2000 does not power up	The DLT2000 has no power	Check the DLT2000 power cord connections with the DLT2000 power switch off
All right-side or all left-side indicators on the DLT2000 front panel blink	A drive fault has occurred	Press the Unload button on the DLT2000 front panel to clear the error. If unsuccessful power off, then on, and look at indicators to determine if POST executed successfully.
You are finding fatal or nonfatal errors for which you cannot determine the cause	The bus termination or SCSI signal cable connections might be incorrect	Make sure the SCSI bus is terminated.
	The ac power source grounding might be incorrect	Use an ac outlet for the DLT2000 on the same ac line powering the system.

After taking the action listed in Table 2-4, power on the DLT2000 to rerun POST. If all right- or left-side lights blink again, you most likely have a hardware failure.

Chapter 3

Configuring and Operating the DLT2000 Basic Tape Drive

3.1 In This Chapter

The configuration section in this chapter applies to the basic drive without the SCSI ID switchpack and power supply. (Chapter 2 applies to configuring the tabletop). Chapter 3 includes these main topics and sections:

Topic	Section
Before You Install the DLT2000 Drive	3.2
Overview of the Front Panel	3.4
Selecting Density	3.3
Description of Controls and Indicators	3.5
Description of the Tape Cartridge	3.6
Loading a Cartridge	3.7
Using the Cleaning Tape Cartridge	3.8
Unloading a Cartridge	3.9
Preserving Cartridges	3.10

3.2 Before You Install the DLT2000 Drive

Section 3.2 includes:

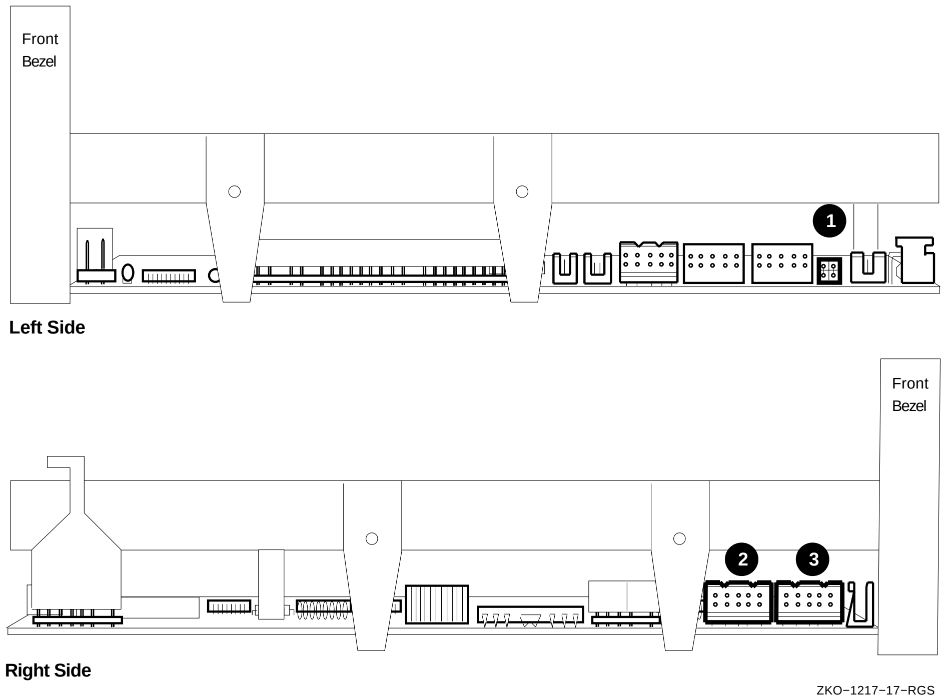
Topic	Section
Disabling Parity Checking	3.2.1
Changing the SCSI ID	3.2.2
Setting the TRM ENB/TRM PWR jumpers	3.2.3
Locating the SCSI Cable and Power Connectors	3.2.4

3.2.1 Disabling Parity Checking

If your system does not generate parity, you can disable parity checking by adding a jumper to the SCSI connector on the left side of the DLT2000 drive (Figure 3-1).

To disable parity:

1. Use Figure 3-1, Number ❷, to locate the SCSI ID connector on the drive.



1. TRM PWR/TRM ENB Connector
2. SCSI ID Connector
3. Loader Connector

Figure 3-1 *DLT2000 Drive Connectors*

Figure 3-2 shows what the pins on the SCSI ID connector represent.

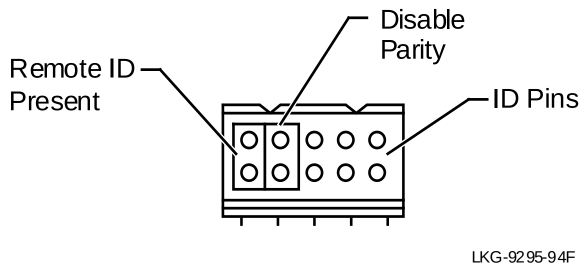


Figure 3-2 *SCSI ID Connector Pins*

Note

A jumper must always be placed on the Remote ID Present position (Figure 3-2) for the host to recognize any ID selection on this connector.

2. Place the jumper in the disable parity check position, as shown in Letter I, Figure 3-3.

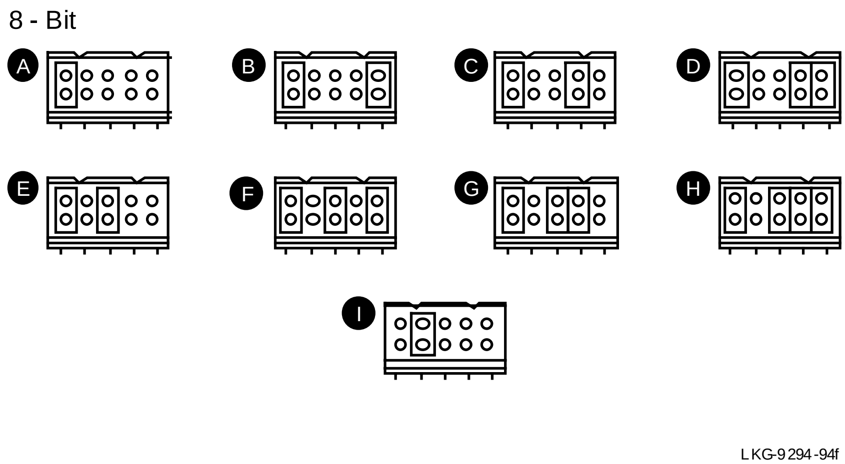


Figure 3-3 *Jumper Positions*

A. SCSI ID 0	D. SCSI ID 3	G. SCSI ID 6
B. SCSI ID 1	E. SCSI ID 4	H. SCSI ID 7
C. SCSI ID 2	F. SCSI ID 5	I. Disable parity checking. The jumper goes in this position with any SCSI ID you choose.

3.2.2 Changing the SCSI ID

The drive is shipped with SCSI ID 5, unless otherwise specified. You can change the SCSI ID by adding jumpers to the drive's SCSI connector (Figure 3-1).

To change the SCSI ID:

1. Use Figure 3-1, number ❷, to locate the SCSI ID connector on the drive.
2. Choose a SCSI ID from 0 to 7.
3. Use Figure 3-3, to see where to place the jumpers for the ID you choose. For example, if you chose SCSI ID 1, place the jumpers in the same positions as those in Letter B.

3.2.3 Setting the TRM ENB (Single-ended Only)/TRM PWR Jumpers

Note

The Small Computer System Interface (SCSI) bus must be terminated at both ends of the bus, and at least one device must supply terminator power.

The single-ended DLT2000 controller module has active terminators. The differential DLT2000 controller module does not have on-board termination. You can configure the single-ended DLT2000 drive to supply termination power and termination on the bus.

To supply terminator power and provide termination for the SCSI bus:

1. Use Figure 3-1, number ➊, to locate the TRM PWR/TRM ENB connector on the drive.
2. Place jumpers in the positions shown in Figure 3-4, number ➍.

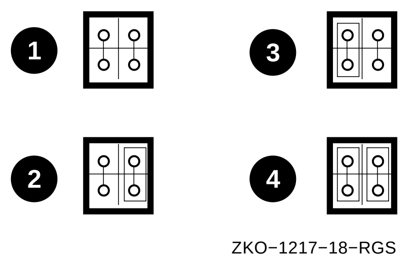


Figure 3-4 *Jumper Settings for TRM PWR/TRM ENB Connector*

➊	No Term Power/Disable Active Termination	➌	Term Power/Disable Active Termination
➋	No Term Power/Enable Active Termination	➍	Term Power/Enable Active Termination

3.2.4 Locating the SCSI Cable and Power Connectors

To install the DLT2000 drive, note the location of the rear connectors (Figure 3-5).

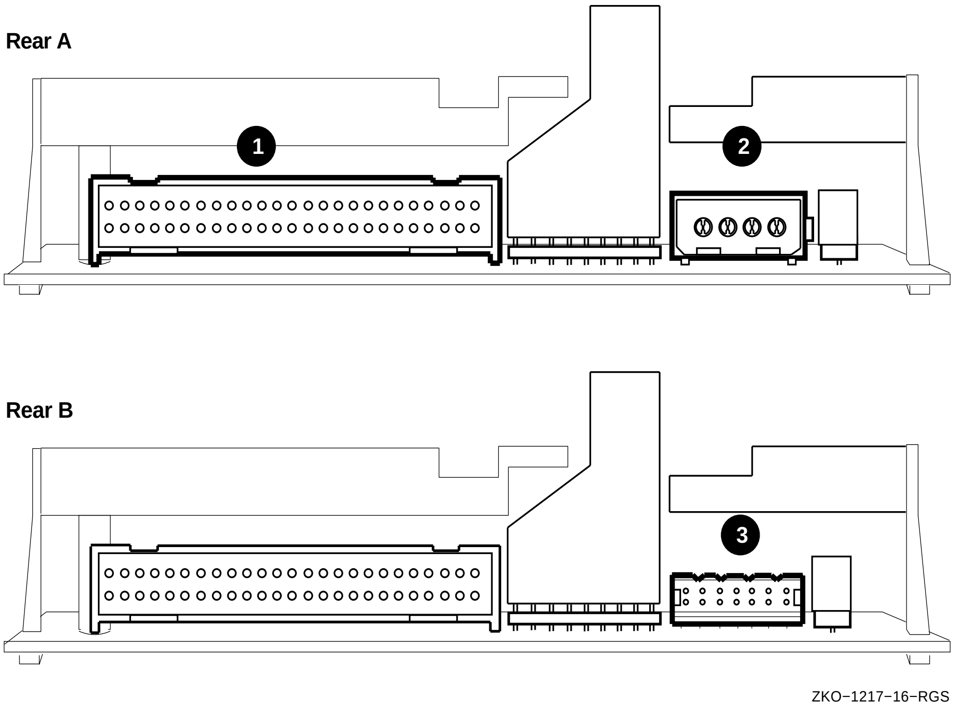


Figure 3-5 *DLT2000 Rear Connectors*

❶	SCSI Connector	❷	Power Connector
		❸	Power Connector (Storage Works Option)

3.3 Selecting Density

Section 3.3 describes the drive's density select features.

Caution

If a prerecorded tape and write from beginning of tape (BOT), all prerecorded data is lost. This includes density changes, since they only occur when writing from BOT.

Ways of Selecting Density

Using CompacTape III the density defaults to 10.0 GB native. The only selection is for this cartridge is 2.6, 6.0 10.0 compression off or 20.0 GB compression on.

Using the CompacTape III the user can select density by using any of the following operations:

1. On all read operations and all write append operations, the recorded density is the density to be used.
2. On a Write from BOT, the tape density may be changed by:
   - The Density Select button. Using the Density Select button always overrides a host selection.
   - A programmable host selection via your operating system. (The Density Override light is off, indicating automatic or host density selection.)
   - Native default density 10.0 and Compress (assuming the Density Select button or the host selection was not used.)

How to Select Density

To select density with the DLT2000:

1. Load the tape in the drive. The yellow Tape in Use light blinks while the tape loads and calibrates.
2. After calibration completes, Tape in Use remains lit.
3. The light shows the tape's prerecorded density, such as 2.6 or 6.0.

4. You can use the drive's control panel at various times, not just after loading a tape. Density selection is inactive until the write from BOT command is issued. The controller remembers the density selection state until you do one of the following:
    - Change the density selection
    - Unload the tape

Density Select Example

If you have loaded a tape with a prerecorded 2.6 density and you use the Density Select button to select 10.0 density, the following should happen:

- The 2.6 light remains lit—density has not changed yet and the steady light indicates recorded tape density
- The 10.0 light blinks—density change is pending
- Density Override lights

When a write from BOT occurs, the following should happen:

- The 2.6 light turns off
- 10.0 lights steadily
- Density Override remains lit

Table 3-1 shows the results of density selection.

Table 3-1 *Results of Density Selection*

If …	Then …
The Density Select button is not used	The lights show the actual density when the tape is reading and writing. The lights are on steady and Density Override is off.
The Density Select button is used, and if the actual tape density is the same as the density you selected	The actual density and the Density Override light. For example, if the actual tape density is 10.0 GB and the selected tape density is 10.0 GB, then the indicator next to 10.0 lights.
The Density Select button is used, and if the actual tape density differs from the density selected	1. The light with the actual density is on steady 2. The light with the selected density blinks 3. Density Override lights steady For example, if the actual tape density is 10.0 and the selected density is 6.0, 10.0 lights steady, 6.0 blinks, and Density Override lights steady.

To select density over the SCSI bus:

1. Do a SCSI MODE SELECT with the density you want. For more details, see Chapter 8.
2. Write data to the tape from BOT.

3.4 Overview of the Front Panel

The DLT2000 has the following indicators and controls for operating the drive Figure 3-6):

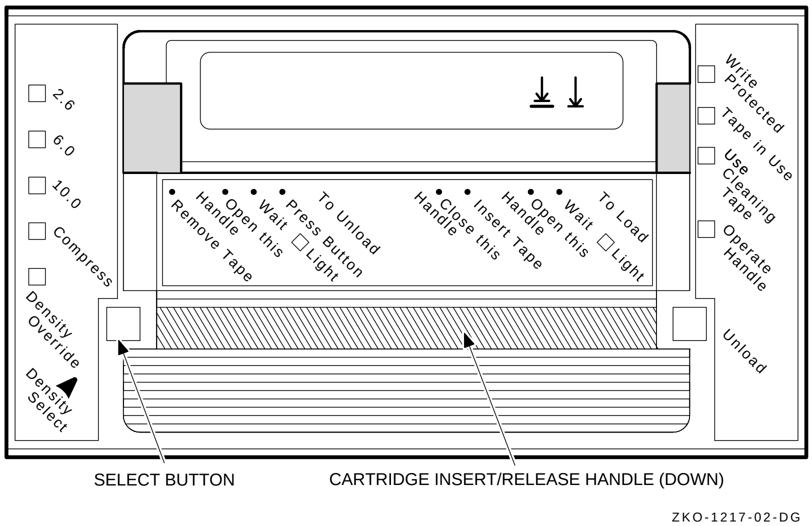


Figure 3-6 *DLT2000 Indicators*

Indicators (Left Side of Drive)	Indicators (Right Side of Drive)
Density light 2.6	Write Protected light
Density light 6.0	Tape in Use light
Density light 10.0	Use Cleaning Tape light
Compress light	Operate Handle light
Density Override light	Beeper (audible) not visible

Controls	
Density Select button	Unload button
Cartridge insert/release handle	

3.5 Description of Controls and Indicators

Section 3.5 includes the following sections:

Topic	Section
Beeper	3.5.1
Unload Button	3.5.2
Cartridge Insert/Release Handle	3.5.3
Indicator Action during Power-on Self-test and Operation	3.5.4

3.5.1 Beeper

A beeper sounds when you can operate the cartridge insert/release handle. When you hear the beep, the green Operate Handle light should be on. To prevent damage to the drive wait for the sound of the beeper before opening the door!!

3.5.2 Unload Button

The Unload button is used primarily to unload the tape. When the user pushes Unload, the DLT2000 waits until an active write to tape is completed before beginning the unload sequence.

The drive then rewinds the tape back into the cartridge. The tape must be completely rewound and unloaded into the cartridge before you can remove the cartridge from the drive. An unload operation may take 20 seconds from BOT.

If the drive is in error state (all right-side lights are flashing on the front panel), pushing the Unload button causes the drive to reset and unload the tape if possible.

3.5.3 Cartridge Insert/Release Handle

Operate the cartridge insert/release handle to load a cartridge or to eject a cartridge only when the Operate Handle light is on, and after the momentary beep sounds. The handle lifts to the open position and lowers to the closed position. See Section 3.7 and Section 3.9 for the operating procedures.

3.5.4 Indicator Action during Power-On Self-Test and Operation

When you turn on system power, the drive performs the power-on self-test (POST). The sequence of events is:

Table 3-2 *POST Sequence of Events*

Stage	What Happens
1.	The lights on the right front panel turn on sequentially from top to bottom. All lights stay on for a few seconds.
2.	The lights on the left front panel turn on at the same time for about three seconds and then turn off.
3.	The green Operate Handle, the orange Write Protected, and the yellow Use Cleaning Tape lights turn off. The yellow Tape in Use light blinks while the tape drive initializes.
4.	After initialization, the drive is in one of the following four states:

Drive State	Indicator Displays and Actions
a. No cartridge is present	1. The yellow Tape in Use light turns off. 2. The green Operate Handle light turns on. 3. The handle is unlatched. 4. The drive beeps momentarily. You can now raise the handle and insert a cartridge.
b. A cartridge is present and the handle is down	The drive loads the cartridge. When the yellow Tape In Use light stops blinking and stays on, the tape's actual density lights. For example, if the actual tape density is 2.6 GB, then the light turns on next to the 2.6 label. When Density Override blinks, you can select a density. The drive is ready for use. (See Section 3.4.)
c. A cartridge is present, but the handle is up (not recommended)	The yellow Tape In Use light turns off. The green Operate Handle light flashes. When you lower the handle, the cartridge loads.
d. A cartridge is not present and the handle could be up (not recommended)	The yellow Tape In Use light turns off. The green Operate Handle light flashes. When you lower the handle, the cartridge loads.

Table 3-2 *POST Sequence of Events Cont'd*

Stage	What Happens	
	Drive State	**Indicator Displays and Actions**
	e. The drive detects an error condition	Then all right or left side lights blink repeatedly. You may try to unload the tape and reinitialize the drive by pressing the Unload button or turn drive power off and then on again. The right- or left-side lights stop blinking and the drive tries to reinitialize. The lights turn on steady again and turn off if the test succeeds.

POST completes in about 15 seconds and the drive responds normally to all commands. However, it might take longer for the media to become ready. After a bus reset, the tape drive responds within a bus selection timeout period. Use this table to determine the drive's operating condition:

Table 3-3 *Determining the Drive's Operating Condition*

Label	Color	State	Operating Condition
Light (Right front panel)			
Write Protected	Orange	On	Tape is write-protected.
		Off	Tape is write-enabled.
Tape in Use	Yellow	Blinking	Tape is moving.
		On	Tape is loaded; ready for use.
Use Cleaning Tape	Yellow	On	Drive head needs cleaning, or the tape is bad (Section 3.8).
		Remains on after you unload the cleaning tape	Cleaning tape attempted to clean the drive head, but the tape expired, so cleaning was not done.
		After cleaning, turns on again when you reload he data cartridge	Problem data cartridge. Try another cartridge.
		Off	Cleaning is complete, or cleaning is unnecessary.

Table 3-4 *Determining the Drive's Operating Condition (cont'd)*

Label	Color	State	Operating Condition
Light (Left Front Panel)			
Operate Handle	Green	On	Okay to operate the cartridge/insert release handle.
		Off	Do not operate the cartridge insert/release handle.
All four right-side lights or all left-side lights	–	On	POST is starting.
		Blinking	An error has occurred. See Table 2-4, DLT2000 Troubleshooting Chart.
2.6	Yellow	On	Tape is recorded in 2.6 format.
		Blinking	Tape is recorded in another density. You selected this density for a write from BOT.
6.0	Yellow	On	Tape is recorded in 6.0 format.
		Blinking	Tape is recorded in another density. You selected this density for a write ROM BOT.
10.0	Yellow	On (default)	Tape is recorded in 10.0 format.
		Blinking	Tape is recorded in another density. You selected this density for a write from BOT.
Compress	Yellow	On	Compression mode is enabled. (Compression can be done in 10.0 density only.)
		Off	Compression mode is disabled.
Density Override	Yellow	On	You selected a density from the front panel.
		Off (default)	Density to be selected by the host (automatic).
		Blinking	You are in density selection mode.

Table 3-4 *Determining the Drive's Operating Condition (cont'd)*

Label	Color	State	Operating Condition
Light (Left Front Panel)			
All four right-side or all left-side lights		Blinking	A POST error occurred.

3.6 Description of the Tape Cartridge

The CompacTape III tape cartridge is a 4-inch, gray/brown, plastic cartridge containing 1100 feet of 1/2 inch magnetic metal particle tape.

3.6.1 Cartridge Write-Protect Switch

The tape cartridge has a write-protect switch to prevent accidental erasure of data. Before loading the tape cartridge into the drive, position the write-protect switch on the front of the cartridge (Figure 3-7).

- Left, so the cartridge is write-protected
- Right, so the cartridge is write-enabled

When you slide the switch to the left, the small orange rectangle is visible. This means data cannot be written to the tape. The arrow (beneath the orange rectangle and over the two lines on the write-protect switch) lets you know that data cannot be written to the tape.

When the switch is moved to the right (the orange rectangle is not visible) the tape can be written.

Figure 3-7 shows the write-protect switch on the tape cartridge :

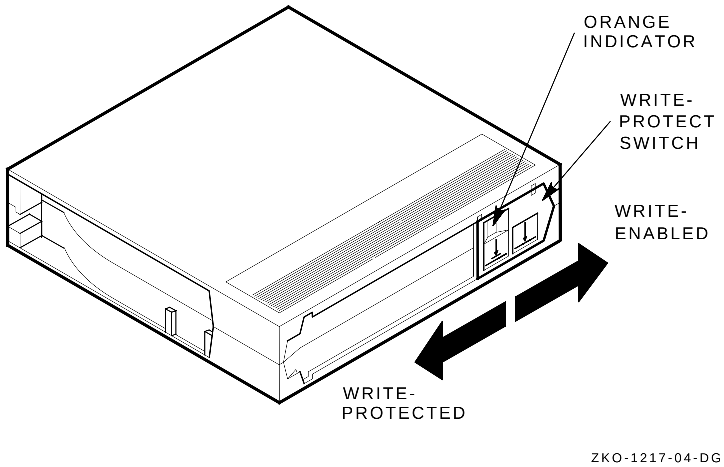


Figure 3-7 *Tape Cartridge*

3.6.2 Data Protection

When the cartridge write-protect switch is to the left, the drive turns on the write protect LED immediately. But, if the drive is writing to the tape, write protect does not take effect until the write completes.

Table 3-5 describes what happens to data protection when you move the write-protect switch before loading the cartridge.

Table 3-5 *Before Loading the Cartridge*

If you move the write-protect switch …	Then …
To the left, the tape is write-protected; the orange indicator on the cartridge shows	Data cannot be written to the tape.
To the right, the tape is write-enabled	Data can be written to the tape (if it is not software write-protected).

Table 3-6 describes what happens to data protection when you move the write-protect switch during operation.

Table 3-6 *After Loading the Cartridge and Operating*

If you move the write-protect switch …	Then …
From the write-protected position to write-enabled	The tape becomes write-enabled after a variable amount of time (seconds).
From write-enabled to write-protected	The tape becomes write-protected after a variable amount of time (seconds).

3.7 Loading a Cartridge

The following are more detailed steps for loading a cartridge (Figure 3-8):

1. When the green light is on steady, pull the cartridge insert/release handle open.
2. Insert the cartridge.
3. Push the cartridge into the drive.
4. Push the handle closed.

The green light turns off and the yellow light blinks to show the tape is loading. When the tape is at the BOT marker, the yellow light turns on steady. The tape is now ready for use.

Figure 3-8 shows how to load a cartridge into the drive.

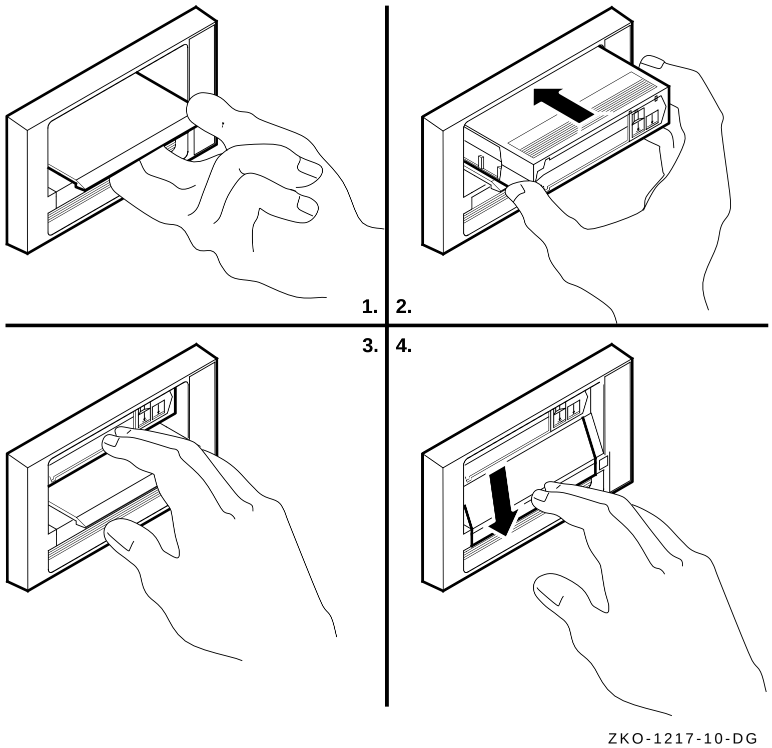


Figure 3-8 *Loading a Cartridge*

3.7.1 Tape in Use

Whenever the yellow Tape in Use light is on steady, the tape is ready to use. When the tape is being read, written, or rewound, Tape in Use light blinks.

Use Table 3-7 to determine what is happening during cartridge use.

Table 3-7 *What is Happening During Cartridge Use (Right Side Lights)*

If …	It means …
The yellow light is on steady	A cartridge is loaded, but the tape is not moving. This can mean no application is communicating with the controller, or that the application is communicating, but is not delivering commands for tape motion.
The yellow light blinks irregularly	A calibration read or write is in progress.
The yellow light blinks regularly	The tape is loading, unloading, or rewinding.
The green light turns on and the beeper sounds	The tape is unloaded into the cartridge and the cartridge can now be removed, or if the drive is unloaded, a cartridge can now be inserted.
All four lights blink	An error has occurred during operation. See Table 2-4, DLT2000 Troubleshooting Chart.

3.8 Using the Cleaning Tape Cartridge

Use Table 3-8 to determine when to use the cleaning cartridge.

Table 3-8 *When to Use the Cleaning Cartridge*

If …	It means …	And you should …
1. Use Cleaning Tape lights (Figure 3-6)	The drive head needs cleaning or the tape is bad (see item 3)	Use the cleaning cartridge. Follow the instructions in Section 3.7 for loading a cartridge into the drive. When cleaning completes, the beeper sounds for you to remove the cleaning cartridge.
2. A data cartridge causes Use Cleaning Tape to blink	The data cartridge may be damaged	Back up this data onto another cartridge. Discard the old cartridge, which may be damaged. A damaged cartridge may cause unnecessary use of the cleaning cartridge.
3. Use Cleaning Tape still lights after you clean the drive head	Your data cartridge may be causing the problem	Try another data cartridge.
4. Use Cleaning Tape lights after you load the cleaning cartridge	Cleaning has not been done and the cartridge is expired	Replace the cleaning cartridge.

Note

The cleaning cartridge expires after about 20 uses.

3.9 Unloading a Cartridge

CAUTIONS

Remove a cartridge from the drive before turning off host system power. Failure to remove a cartridge can result in cartridge and drive damage.

When you remove the cartridge from the drive, return the cartridge to its plastic case to prolong the cartridge life.

To unload a cartridge from the drive (Figure 3-9):

1. Press the Unload button (or issue the appropriate system software command). The yellow Tape in Use light blinks as the tape rewinds.
2. When the green light turns on (the beeper also sounds), pull the cartridge insert/release handle open to eject the cartridge.

CAUTION

Immediate extraction of the tape cartridge can lead to tape leader failure. Delay tape cartridge extraction by one to two seconds to avoid this problem.

3. Remove the cartridge.
4. Push the handle closed.

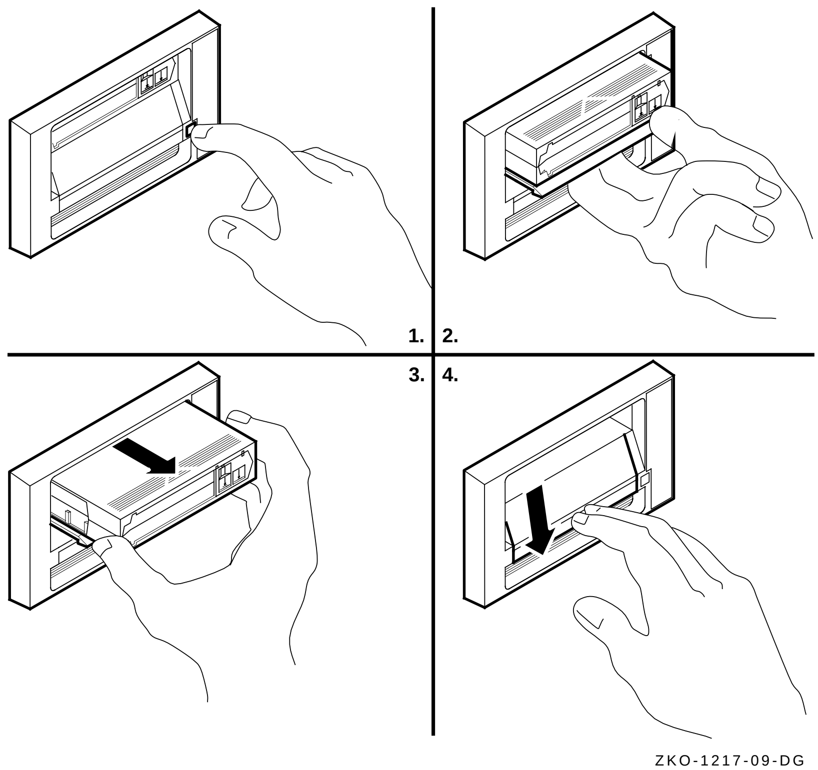


Figure 3-9 *Unloading a Cartridge*

3.10 Preserving Cartridges

For longer life of recorded or unrecorded cartridges, store cartridges in a clean environment with these conditions:

- Do not drop or bang the cartridge. This can displace the tape leader, making the cartridge unusable and possibly damaging the drive.
- Keep tape cartridges out of direct sunlight and away from heaters and other heat sources.
- Store tape cartridges in temperatures between 10°C and 40°C (50°F to 104°F). For longer cartridge life, always store the cartridge in its plastic container and in room environment conditions of 72°F ±7°F (22°C ±4°C).
- If the tape cartridge has been exposed to heat or cold extremes, stabilize the cartridge at room temperature for the same amount of time it was exposed---up to 24 hours.
- Do not place cartridges near electromagnetic interference sources, such as terminals, motors, and video or X-ray equipment. Data on the tape can be altered.
- Store tape cartridges in a dust-free environment where the relative humidity is between 20% and 80%. For longer cartridge life, store the cartridge at 40% ± 20% relative humidity.
- Place an identification label only in the slide-in slot on the front of the cartridge.
- Do not adhere labels to a cartridge anywhere except in the slide-in slot.

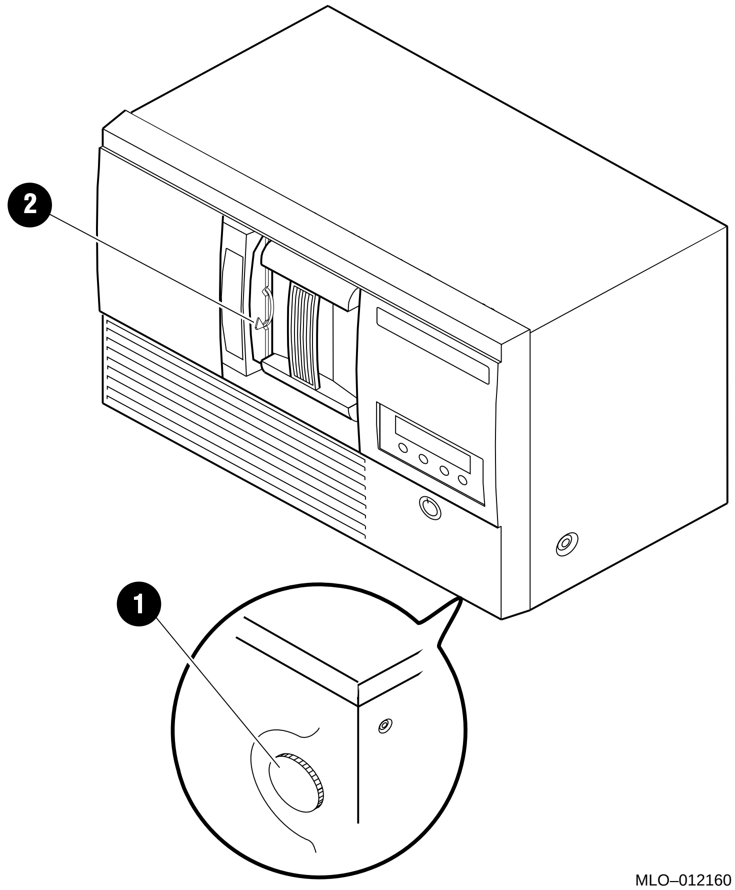
Chapter 4

Configuring and Operating the DLT2500 Mini-Library

4.1 In This Chapter

The configuration section in this chapter applies to the mini-library and its operation. Chapter 4 includes these main topics and sections:

Topic	**Section**
Introduction to the Mini-Library	4.2
Configure the DLT2500 Mini-Library	4.3
Installation Test	4.4
Operator Control Panel	4.5
Key Lock	4.6
Selecting Density	4.7
Default Operating Modes	4.8
Tape Cartridge Description	4.9
Magazine Description	4.10
When to Use the Cleaning Tape Cartridge	4.11



➊	Shipping Screw	➋	Locking Lever

Figure 4-1 *Loosening the Shipping Screw Under the Mini*-Library

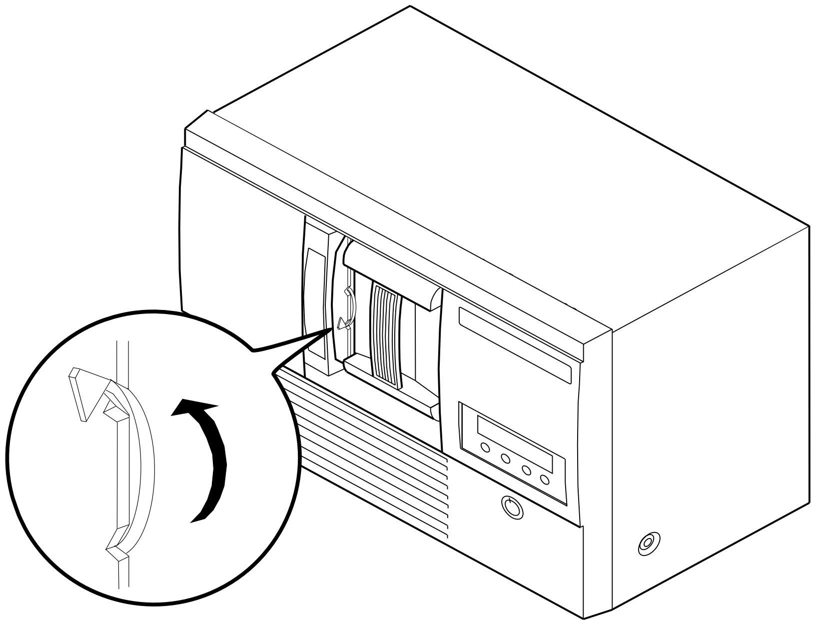
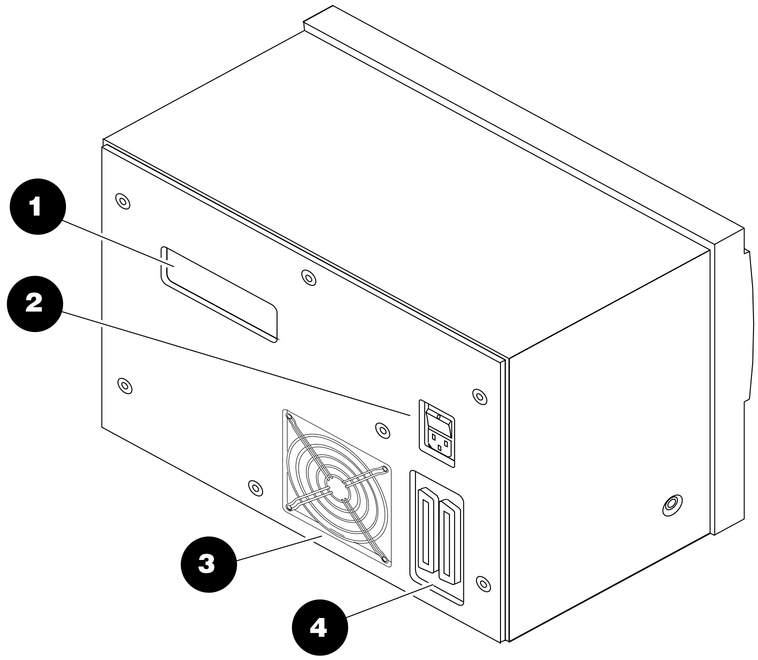


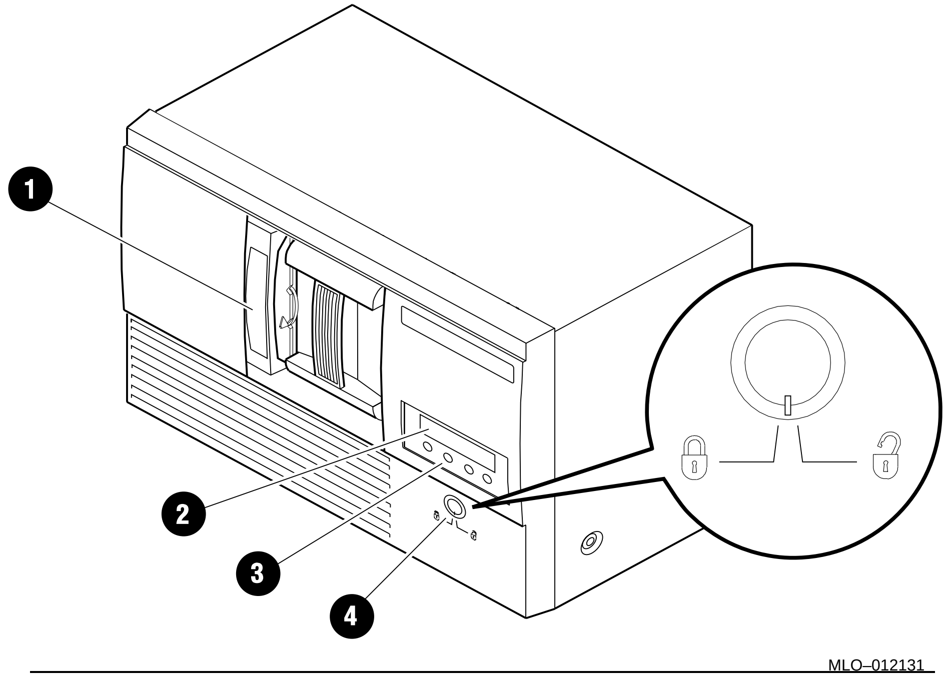
Figure 4-2 *Rotate the Locking Lever*

Lift the locking lever on the front of the mini-library (Figure 4-2) to rotate the magazine locking mechanism. This allows you to remove the magazine from the mini-library.



❶	Label	❷	Power Switch/Power Connector
❸	Fan	❹	SCSI Connectors

Figure 4-3 *Mini-Library Rear Panel Components*



❶ Magazine Door	❷ Display	❸ Operator Buttons	❹ Key Lock

Figure 4-4 *Front of the DLT2500*

4.2 Introduction to the Mini-Library

The mini-library includes a DLT2000 tape drive, a media loader, and a 5-cartridge removable magazine.

The same SCSI target controller board controls the tape drive and the media loader. If the controller detects the loader's presence when the system is turned on, the loader is presented as a SCSI-2 medium changer device on LUN 1.

If you issue the SCSI-2 medium changer commands to the DLT2500:

- *Random access is enabled* to the media stored in the magazine slots
- *Sequential access is disabled* to the media supported automatically in auto-loading mode

If you do not issue the SCSI-2 medium changer commands, the default mode of operation is sequential access to the media supported automatically in auto-loading mode.

Auto-loading is implemented as a side effect of the SCSI UNLOAD command, as shown:

If …	Then …
An unload is specified	After winding the tape back into the cartridge and moving the cartridge from the drive to the magazine slot from which it came, the cartridge in the next slot is moved from the magazine into the drive and made ready.
The next slot is empty, or the cartridge unloaded was for the last slot in the magazine	No cartridge is loaded into the drive.

4.3 Configure and Install the DLT2500 Mini-Library

This section describes how to configure and install the mini-library including:

- Configuration guidelines
- Connecting the SCSI signal cable to the mini-library

The mini-library is factory set to SCSI ID 5, unless otherwise specified.

4.3.1 Configuration Guidelines

Your system uses the SCSI ID to identify, or address, the mini-library. Follow these guidelines when you configure the mini-library for your system:

If you are installing the mini-library as …	Then …
The only SCSI device on the bus or one of multiple SCSI devices on the bus	Be sure to use a SCSI ID that is unique from any other device or system ID on the SCSI bus. If you need to change the SCSI ID, see the section on setting the SCSI ID, later in this chapter.
The last or only device on the SCSI bus	The user must terminate the bus by installing a terminator.

4.3.2 Connecting the SCSI Signal Cable to the Mini-Library

Examine the components on the mini-library rear panel (Figure 4-3) to complete the physical installation.

To connect the SCSI signal cable:

1. Ensure the mini-library power is turned off.
2. Connect one end of the SCSI cable to an available SCSI signal connector on the mini-library rear panel.
3. Snap the wire cable clamps into place or tighten the screws (whichever is supplied) to secure the cable.
4. Connect the other end of the SCSI signal cable to the SCSI connector on your system, or for daisy-chained configurations, to another SCSI device.

See your system documentation for system SCSI connections.

4.4 Test the Installation

This section tells you how to run the power-on self-test (POST) and what to do after POST.

4.4.1 Run POST

To test the installation for the mini-library by running POST:

1. Turn on the system power.
2. Set the power switch on the mini-library rear panel to on.

   Result: POST runs automatically when you turn on the mini-library
3. Watch the display on the mini-library front panel. Ensure the sequence of events are the same as listed:

Event	Action
1	The message LDR RST (loader reset) displays.
2	The message LDR ACT (loader active) displays.
3	A series of numbers display as the mini-library elevator goes up and down.
4	The message LDR RDY (loader ready) displays.

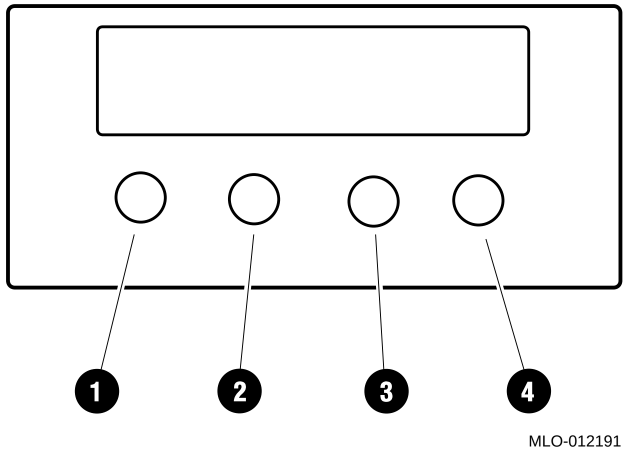
4.4.2 What to Do after POST

Verify whether the POST events took place.

If …	Then …
All the events took place	POST succeeded. The mini-library is ready for operation.
All the events did not take place	POST failed. You should see the message LDR RST (loader reset) display. 1.Verify you terminated the SCSI bus. 2.Turn the mini-library power off and then on again. If POST still does not succeed, call your service representative.

4.5 Operator Control Panel

The operator control panel (OCP) has 4 pushbuttons (Figure 4-5 and Table 4-1).



❶	**Display Mode**	❷	**Select**	❸	**Load/ Unload**	❹	**Open**

Figure 4-5 *Mini-Library Operator Control Panel*

Table 4-1 lists each button and its function.

Table 4-1 *Mini-Library Operator Control Panel*

Button	Function
Display Mode	Puts the mini-library in Normal, Density Select, or SCSI ID Select mode.
Select	• Selects SCSI ID and density. • Moves in increments the current slot number on the display to the next slot number .
Load/Unload	• Loads the currently selected cartridge into the tape drive • Unloads the cartridge currently in the tape drive • Resets the mini-library if a loader error has occurred. When the ERR LDR message displays, press the Load/Unload button to reset the mini-library.
Open	• Opens the magazine door to access the magazine for loading and unloading cartridges. • Unloads the cartridge currently in the tape drive and returns the cartridge to its original slot. Then, opens the magazine door.

Table 4-2 lists the display messages you can see during operation.

Table 4-2 *Display Messages*

Display Message	Tells you …
WP	The cartridge in the drive is write-protected by one of these methods: • The write-protect switch on the cartridge is set to the write-protect position • Host software write-protect qualifiers
DRV ACT	Tape is reading or writing
DRV RDY	A cartridge is in the drive and the tape is not moving.
DRV REW	Tape is rewinding.
HC	Use cleaning tape.
LDR RDY	Power is on and no cartridge is in the drive.
LDR ACT	Loader is moving a cartridge.
ERR MAG	The status of cartridges reported by the loader and the drive is inconsistent.
ERR LDR	A loader transfer assembly error occurred.
ERR DRV	A drive error occurred.
ERR CTL	A controller error occurred.
ERR UNK	An error of unknown origin occurred.
SLOT 0 SLOT 1 SLOT 2 SLOT 3 SLOT 4	The current slot containing the cartridge. Each current slot number flashes in the display when its corresponding cartridge moves to or from the drive. Also used with the ERR MAG or ERR LDR message to show the type of error.
DNS SEL	The mini-library is in Density Select mode.

Table 4-2 *Display Messages (Cont'd)*

Display Message	Tells you …
OVR	Tape drive activity as follows: • On steady means you selected a density from the front panel. • Off (default) means density is selected automatically. • Flashing means you are in density select mode.
2.6	Tape drive activity as follows: • On steady means the tape is recorded in 2.6 format. • Flashing means the tape is recorded in another density. You selected this density for a write from BOT.
6	Tape drive activity as follows: • On steady means the tape is recorded in 6 GB format. • Blinking means the tape is recorded in another density. You selected this density for a write from BOT.
10	Tape drive activity as follows: • On steady means the tape is recorded in 10 GB format. • Flashing means the tape is recorded in another density. You selected this density for a write from BOT.
10C	Tape drive activity as follows: • On means Compression mode is enabled. Compression can be done in 10 GB density only. • Off means Compression mode is disabled.

4.6 Key Lock

The key lock on the front of the mini-library (Figure 4-3) enables or disables use of the operator control panel (OCP) (Figure 2-5). The key lock prevents unauthorized removal of the magazine or cartridges, providing a measure of data security.

To unlock or enable the OCP, turn the key toward the opened lock icon next to the key lock.

To lock or disable the OCP, turn the key toward the locked icon next to the key lock.

CAUTION

Do not force open the magazine door manually. Always use the Open button to open the door electronically.

4.6.1 OCP Locked or Disabled

When you insert the magazine into the mini-library and close the magazine door, the elevator scans the magazine. The OCP pushbuttons are disabled.

4.6.2 OCP Unlocked or Enabled

The OCP pushbuttons unlocked or enabled allow operator intervention.

4.6.3 Setting the SCSI ID

Choose an unused SCSI ID between 0 and 7.

To set the SCSI ID via the front panel:

1. Press and hold the Display Mode button (about 5 seconds) until the SCSI ID SEL message displays including the factory set SCSI ID.

Example

SCSI ID SEL **SCSI ID 0**

2. Keep pressing the Select button quickly until the ID number you want displays (Figure 4-5).
3. Press the Display Mode button again. See the display message LDR RDY. At this point, the mini-library drive cannot yet recognize the SCSI ID.

4. Issue a bus reset or turn the mini-library power off and then on again so the drive can recognize the new SCSI ID.

4.7 Selecting Density

This section describes the mini-library's density select feature.

Caution

If a prerecorded tape and write from beginning of tape (BOT), all prerecorded data is lost. This includes density changes, since they only occur when writing from BOT.

The user can select density by using any of the following:

1. On a write from beginning of tape (BOT), tape density is selected by one of the following:
   - Front panel Density Select mode

NOTE

The user can execute a front panel density selection at any time, but the selection takes effect only on the next write from BOT.

   - Programmable host selection via your operating system
   - Native default density 10 GB and Compress (assuming you did not use the Select mode or the host selection)
2. On all read operations and all write append operations, the recorded density is the density to be used.

CAUTION

Doing any write from BOT destroys existing data on tape.

4.7.1 Front Panel Density Select Mode

To select density via the front panel:

1. If a tape is loaded in the drive, the display shows the tape's pre-recorded density.
2. The user can use the mini-library OCP at various times, not just after you load a tape. Density selection is inactive until you issue the write from BOT command. The controller remembers the density selection state until you do one of the following:
    - Change the density selection
    - Press the Open button to open the door
3. Enter Density Select mode by pressing the Display Mode button and then the Select button on the OCP. Using Density Select mode always overrides a host selection.

Example

If you loaded a tape with a prerecorded 2.6 density and you use Density Select mode to select 10 density:

Before a write from BOT occurs, you should see the 2.6 show steady, and the 10 and OVR flash in the display:

LDR RDY		
2.6	**10**	**OVR**

After a write from BOT occurs, you should see the selected density 10 and the OVR show steady in the display:

LDR RDY		
	10	**OVR**

Table 4-3 shows results.

Table 4-3 *Results of not Using or Using Density Select Mode*

If …	Then…
You did not use Density Select mode	The display shows the actual density when the tape is reading and writing.
You used Density Select mode and the actual tape density is the same as the density you selected	The display shows the actual density on steady and OVR on steady.
You used Density Select mode and the actual tape density differs from the density you selected	On operation before Write from BOT, the display shows: 1. Actual tape density on steady **2.** Selected density flashing 3. OVR flashing On operation after write from BOT, the display shows: 1. Selected density on steady 2. OVR on steady

4.7.2 Programmable Host Selection via Your Operating System

To select density via the SCSI bus:

1. Do a SCSI MODE SELECT with the density you want. For more details, see the chapter on *SCSI Interface.* .
2. Write data to the tape from BOT.

4.7.3 Native Default Density

If you did not use the front panel density select mode or programmable host selection, the selection becomes the native default density of 10 GB when using a CompacTape III tape (uncompressed).

4.8 Default Operating Modes

The mini-library operates in 4 modes:

- Normal
- Density Select
- SCSI ID Select
- Code Update

4.8.1 Normal Mode

Normal mode is used by default after you turn on or reset the mini-library. The information displayed during this mode depends on the state of the mini-library.

If the display says …	It means the …
LDR ACT	Loader is active
LDR RDY	Loader is inactive and no cartridge is in the drive
DRV RDY	Drive is ready
DRV ACT	Drive is active
DRV REW	Tape is rewinding
HC	Use cleaning tape
WP	Drive is in write-protect status

Switch Functions

While in Normal mode:

When you press and release the Display Mode button, the mini-library enters Density Select mode.

When you press and hold the Display Mode button (about 5 seconds), the mini-library enters SCSI ID Select mode.

4.8.2 Density Select Mode

Density Select mode allows you to select drive density.

If the display says …	It means the …
DNS SEL	Mini-library is in Density Select mode
OVR	Front panel selection overrides host selection
DRV RDY	Drive is ready
DRV ACT	Drive is active
DRV REW	Tape is rewinding
HC	Use cleaning tape
WP	Drive is in write-protect status

Switch Functions

While in Density Select mode:

When you press and release the Display Mode button once, the mini-library enters Normal mode.

4.8.3 SCSI ID Select Mode

SCSI ID Select mode allows you to select the SCSI ID for the tape drive and to enter Code Update mode. If you turn power off and then on again or reset the mini-library, the SCSI ID you chose reappears after being stored.

If the display says …	It means the …
SCSI ID SEL	Mini-library is in SCSI ID Select mode
SCSI ID 0	SCSI ID is set to 0
SCSI ID 1	SCSI ID is set to 1
SCSI ID 2	SCSI ID is set to 2
SCSI ID 3	SCSI ID is set to 3
SCSI ID 4	SCSI ID is set to 4
SCSI ID 5	SCSI ID is set to 5
SCSI ID 6	SCSI ID is set to 6
SCSI ID 7	SCSI ID is set to 7

If you press the Select button while in SCSI ID Select mode, the stored SCSI ID you chose moves by one increment. If you press the Select button when the stored SCSI ID is 7, then the SCSI ID moves to 0.

Switch Functions

While in SCSI ID Select mode:

If you press and release the Display Mode button, the mini-library enters Normal mode.

4.8.4 Code Update Mode

See Chapter 7 to place the mini-library in Code Update mode.

4.9 Description of the Tape Cartridge

The CompacTape III tape cartridge is a 4-inch, gray, plastic cartridge containing 1100 feet of 1/2 inch magnetic metal particle tape.

4.9.1 Cartridge Write-Protect Switch

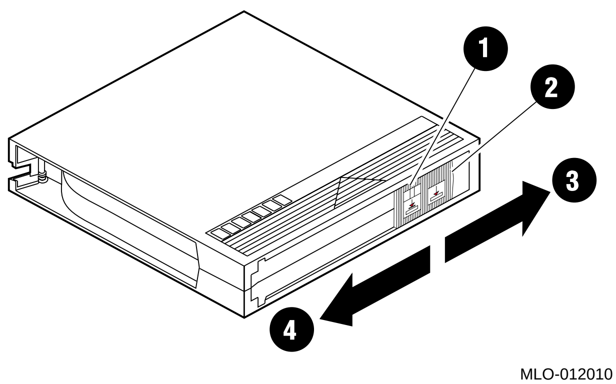
The tape cartridge has a Write-Protect switch to prevent accidental erasure of data. Before you load the tape cartridge into the drive, position the write-protect switch on the front of the cartridge (Figure 4-6). The switch can move to the:

- Left, so the cartridge is Write-Protected
- Right, so the cartridge is Write-Enabled

When you slide the switch to the left, the small orange rectangle is visible. This means data cannot be written to the tape. The arrow (beneath the orange rectangle and over the two lines on the write-protect switch) lets you know that data cannot be written to the tape.

On the right side of the write-protect switch is another symbol: an arrow over one line. This symbol indicates that if you slide the write-protect switch to the right, data can be written to the tape.

Figure 4-6 shows the write-protect switch on the tape cartridge.



❶	Orange Indicator	❷	Write-Protect Switch	❸	Write-Enabled	❹	Write-Protected

Figure 4-6 *Write-Protect Switch on a Cartridge*

4.9.2 Data Protection

If you move the cartridge write-protect switch to the left, and then load the tape, the WP (write-protect) message displays.

Table 4-4 describes what happens to data protection when you move the write-protect switch before you load the cartridge.

Table 4-4 *Before Loading the Cartridge*

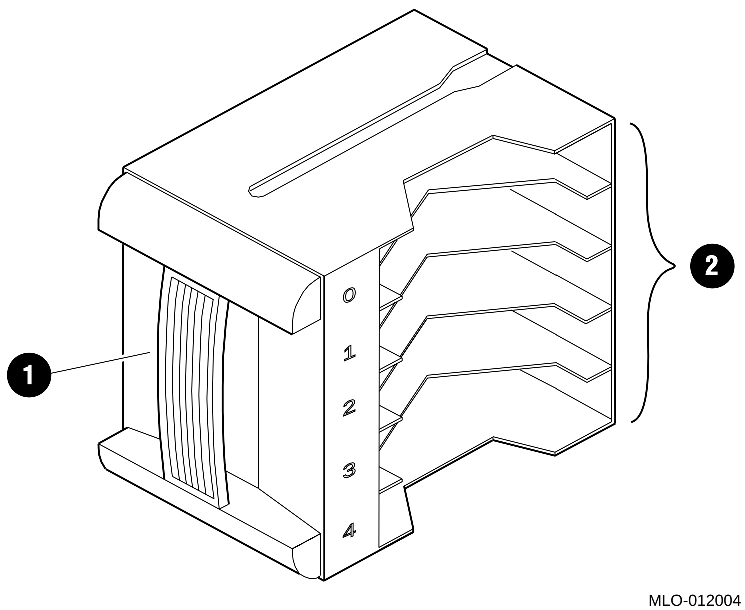
If you move the write-protect switch …	Then …
To the left, the tape is write-protected, with the orange indicator showing	Data cannot be written to the tape.
To the right, the tape is write-enabled	Data can be written to the tape (if it is not software write-protected).

4.10 Description of the Magazine

The front of the magazine has numbers 0 through 4 to indicate each slot number.

NOTE

Insert and remove all cartridges at the *front* of the magazine.



❶ Magazine Handle ❷ Cartridge Slots

Figure 4-7 *DLT2500 Magazine*

4.10.1 Inserting a Cartridge into the Front of the Magazine

Before cartridge insertion:

1. Grasp the cartridge with the write-protect switch on the right side facing you.
2. Set the cartridge's write-protect switch to the desired position.

If you want to …	Then …
Write to the tape	Slide the switch to the right (orange indicator is not visible)
Write-protect the tape	Slide the switch to the left (orange indicator is visible)

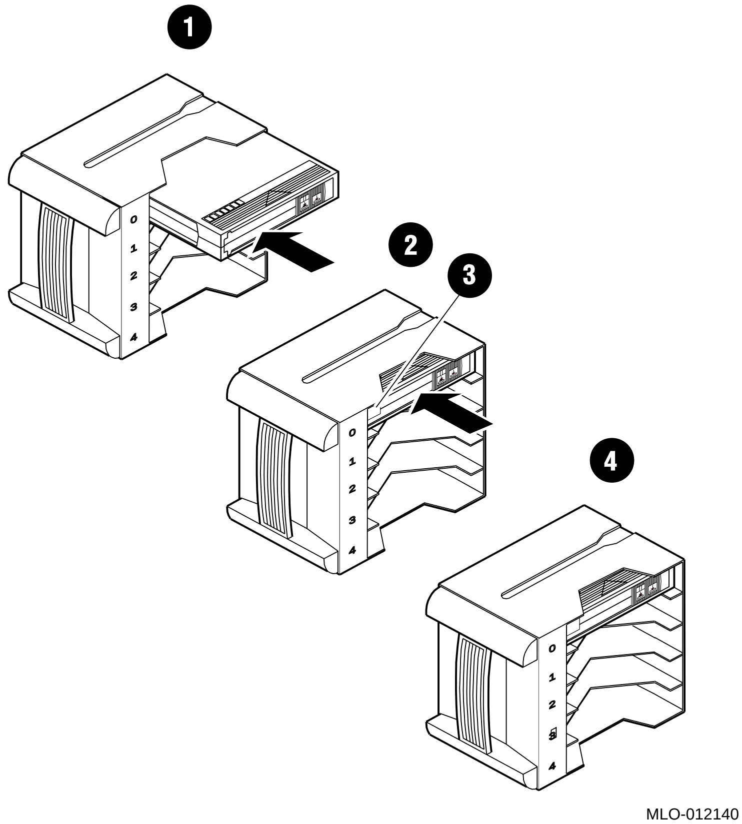


Figure 4-8 *Inserting a Cartridge into the Magazine*

To insert a cartridge into the magazine (Figure 4-8):

❶ Place the magazine on a flat surface with the slots facing you. Each slot is numbered to ensure you are inserting the cartridge correctly in the front of the magazine. Usually, cartridges are inserted into consecutive slots.

❷ Insert the cartridge by pushing it into the slot until you hear a click.

❸ Notice a small metal tab. ❹ This holds the cartridge in place.

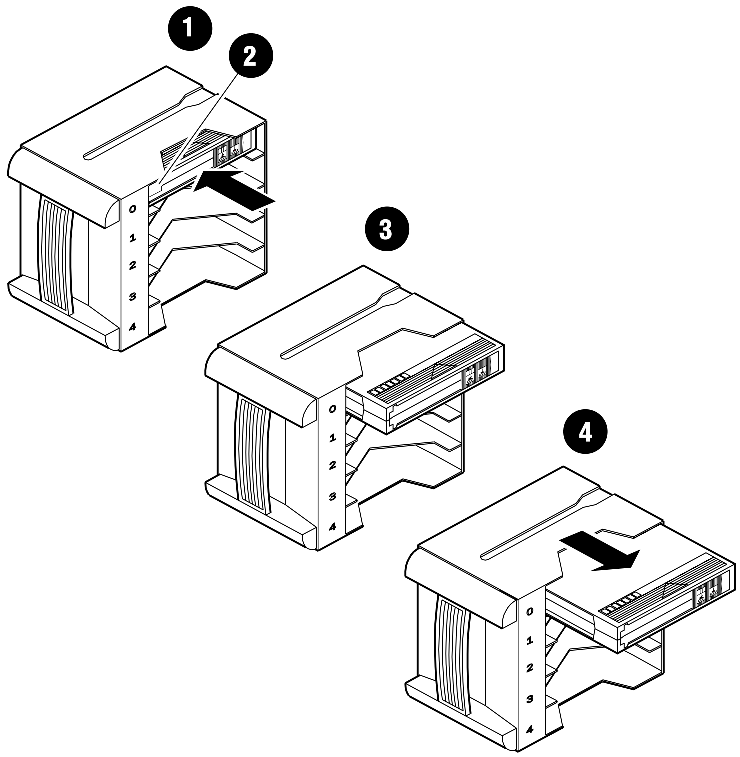


Figure 4-9 *Removing a Cartridge from the Magazine*

4.10.2 Removing a Cartridge from the Magazine

To remove a cartridge from the magazine (Figure 4-9):

❶ At the front of the magazine, ❷ where you can see the metal tab next to the slot number, press in on the cartridge until it stops and you hear a click.

❸ Then, release.

❹ The slot has a spring-release action.

NOTE

Never apply labels to the top or bottom of tape cartridges. Doing so can cause cartridge jams in the mini-library. Use the space on the front of the cartridge for labels.

4.10.3 Removing the Magazine from the Mini-Library

To remove the magazine from the mini-library, first ensure the OCP is enabled or unlocked via the key lock (Figure 4-3).

Then:

1. If a tape is loaded in the drive, press the Load/Unload button to unload the tape from the drive and load it into the magazine. Press the Open button (Figure 4-5) to open the door of the mini-library. (Pressing just the Open button also returns the tape to the magazine and opens the door.)
2. Slide the door all the way to the left.
3. Grasp the magazine's handle and pull the magazine out of the mini-library.

4.10.4 Installing the Magazine into the Mini-Library

To install the magazine into the mini-library, open the mini-library door by pressing the Open button.

CAUTION

Do not force open the magazine door manually. Always use the Open button to open the door electronically

Ensure the door is moved all the way to the left.

1. Hold the magazine by the handle (Figure 4-7) and slide the magazine into the mini-library doorway. Since the magazine is slotted, you can insert the magazine in the correct orientation only.
2. Slide the door to close.
3. Ensure the door is fully closed before you proceed.

4.10.5 Selecting a Cartridge from the Magazine

After a successful initialization, the mini-library automatically selects the first slot containing a cartridge and the Select button becomes active.

To select a cartridge: press the Select button to advance to the next slot containing a cartridge.

4.10.6 Loading the Cartridge into the Drive

To load the cartridge from the magazine into the drive: press the Load/Unload button. Table 4-5 explains what happens after you press the button.

Table 4-5 *After Loading the Cartridge*

Stage	What Happens
1	The elevator moves to the selected slot.
2	The cartridge is then removed from the magazine and placed in the elevator.
3	The elevator moves to the drive position and inserts the cartridge into the drive.
4	The display reads LDR ACT until the tape loads to BOT.
5	After the cartridge is inserted into the drive, the display reads DRV ACT.
6	After the cartridge is fully loaded and at BOT, the display reads DRV RDY.

4.10.7 Unloading the Cartridge

CAUTION

Do not press the Load/Unload button until backup or other tape operations are stopped at the terminal. Doing so can result in operation failure and drive unavailability.

If …	Then …
You want to unload the cartridge from the drive	Press the Load/Unload button. • The DRV REW message displays • The cartridge unloads from the drive and the display reads LDR ACT. When the cartridge returns to the magazine, the display reads LDR RDY.
The ERR LDR message displays, showing a malfunction	Press the Load/Unload button to reset the mini-library and try to clear the error.

4.10.8 Opening the Magazine Door

The Open button opens the magazine door for inserting or removing the magazine. The button is disabled when the key lock is in the locked or disabled position.

When …	Then …	You should …
A cartridge is not in the drive	The LDR RDY message displays before any operation begins.	Press the Open button. The door opens.
A cartridge is in the drive	The DRV RDY message displays before the operation begins	Press the Open button so the cartridge unloads from the drive and moves back into the magazine. The door opens.

Result: In both situations, once you close the door again, a magazine scan begins. The LDR ACT message displays. When the scan completes, LDR RDY message displays.

4.11 When to Use the Cleaning Tape Cartridge

Use Table 4-6 to determine when to use the cleaning cartridge.

Table 4-6 *When to Use the Cleaning Cartridge*

If …	It means …	And you should …
1. The HC message displays	The drive head needs cleaning or the tape is bad (item 3 in this table).	Use the cleaning cartridge. Follow the instructions in this chapter to insert a cartridge into the magazine and load into the drive. When cleaning completes, the cleaning cartridge unloads from the drive and returns to the magazine. The LDR RDY message displays.
2. A data cartridge causes the HC message to display frequently	The data cartridge may be damaged.	Back up this data onto another cartridge. Discard the old cartridge, which may be damaged. A damaged cartridge may cause unnecessary use of the cleaning cartridge.
3. The HC message still displays after you clean the drive head	Your data cartridge may be causing the problem.	Try another data cartridge.
4. The HC message displays after you load the cleaning cartridge	Cleaning has not been done and the cartridge is expired.	Replace the cleaning cartridge.

NOTE

The cleaning cartridge expires after about 20 uses.

Chapter 5

Configuring and Operating the DLT2700 Mini-Library

5.1 In This Chapter

Chapter 5 includes these main topics and sections:

Topic	Section
Introduction to the Media Loader	5.2
Configure the DLT2700	5.3
Mode Select Key	5.4
Selecting Density	5.5
Operator Control Panel (OCP)	5.6
Power-On Process	5.7
Slot Select, Load/Unload, and Eject Button Functions	5.8
Magazine	5.9

5.2 Introduction to the Mini-Library

The mini-library option includes a DLT2000 tape drive, a media loader, and a 7-cartridge removable magazine.

The same SCSI target controller board controls the tape drive and the media loader. The tape drive is always LUN 0. If the controller detects the loader's presence when the system is turned on, the loader is presented as a SCSI-2 medium changer device on LUN 1.

The SCSI-2 medium changer commands allow:

- Random access to the media stored in the magazine slots
- Sequential access of the media supported automatically in auto-loading mode

Auto-loading is implemented as a side effect of the SCSI UNLOAD command.

If …	**And …**	**Then …**
An unload is specified	A media loader is present	After winding the tape back into the cartridge and moving the cartridge from the drive to the magazine slot from which it came, the cartridge in the next slot is moved from the magazine into the drive and made ready.
The next slot is empty, or the cartridge unloaded was for the last slot in the magazine		No cartridge is loaded into the drive.

5.3 Configure the DLT2700

This section describes how to configure the DLT2700 including:

Topic	**Section**
Configuration Guidelines	5.3.1
Switchpack Location	5.3.2
Disable Parity Checking	5.3.2
Change the SCSI ID	5.3.3

The DLT2700 is factory set to SCSI ID5, unless otherwise specified.

If your system generates parity, the DLT2700 can check for correct parity on the SCSI bus.

5.3.1 Configuration Guidelines

Your system uses the SCSI ID to identify, or address, the DLT2700. Follow these guidelines when configuring the DLT2700 for your system:

If you install the DLT2700 as …	Then …
The only SCSI device or one of multiple SCSI devices on the bus	Be sure to use a SCSI ID that is unique from any other device or system ID on the SCSI bus.
The last or only device on the SCSI bus	The user must terminate the bus by installing a terminator.

5.3.2 Disable Parity Checking

To disable parity, see your service representative.

5.3.3 Change the SCSI ID

The user can change the SCSI ID via the pushbutton switch on the mini-library rear panel. Press the switch button(s) above or below the number display (0-7) to set the desired SCSI ID. Press the top button to increase the number or press the bottom button to decrease the number.

Figure 5-1 shows the location of the SCSI ID pushbutton switch.

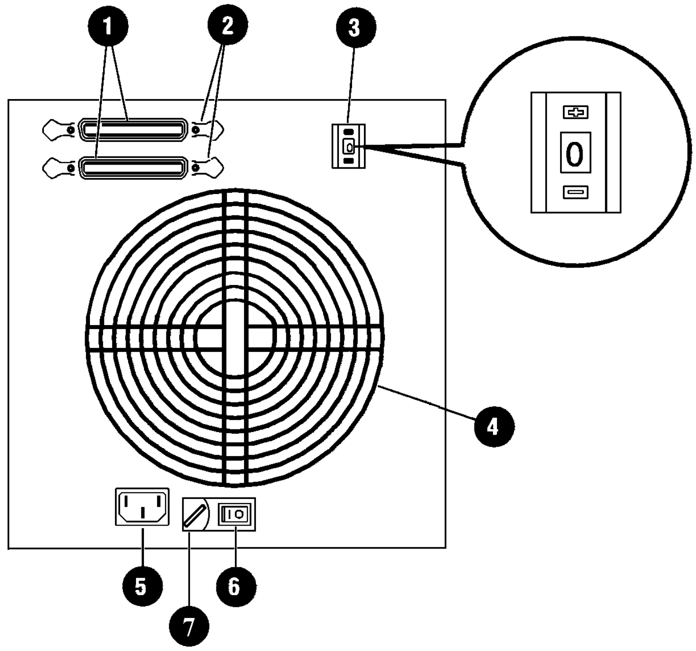


Figure 5-1 *Changing the SCSI ID via the Pushbutton Switch*

❶ SCSI Connector	❷ Wire Cable Clamps	❸ Pushbutton Switch
❹ Fan	❺ Power Connector	❻ Power Switch
❼ Voltage Selection Switch		

5.4 Mode Select Key

The Mode Select key (Figure 5-2), on the front of the loader, locks the loader transfer assembly into the enclosure and locks the receiver closed. The key has four modes:

Mode	Use
OCP Disabled	Operational
Automatic	Operational
Manual	Operational
Service	Servicing procedures

5.4.1 OCP Disabled Mode

When the magazine is inserted into the receiver and the receiver is closed, the loader transfer assembly scans the magazine. The first cartridge in the magazine automatically loads into the drive.

When you copy data to the tape, operations stop if one of the following happens:

- Storage capacity of the last tape cartridge is exceeded
- No tape cartridge is in the next sequential slot in the magazine

To lock the DLT2700 subsystem into the enclosure and lock the receiver, set the Mode Select key to OCP Disabled. The OCP pushbuttons are disabled.

The following results of setting the Mode Select key to OCP disabled are:

- The OCP pushbuttons are disabled.
- SCSI media changer commands are disabled.
- If the receiver were open and a magazine were then inserted, the lowest-numbered cartridge is automatically loaded into the drive. Subsequently, issuing the SCSI ‘unload’ command would unload the cartridge and load the next higher-numbered cartridge.

Figure 5-2 shows the operator's control panel.

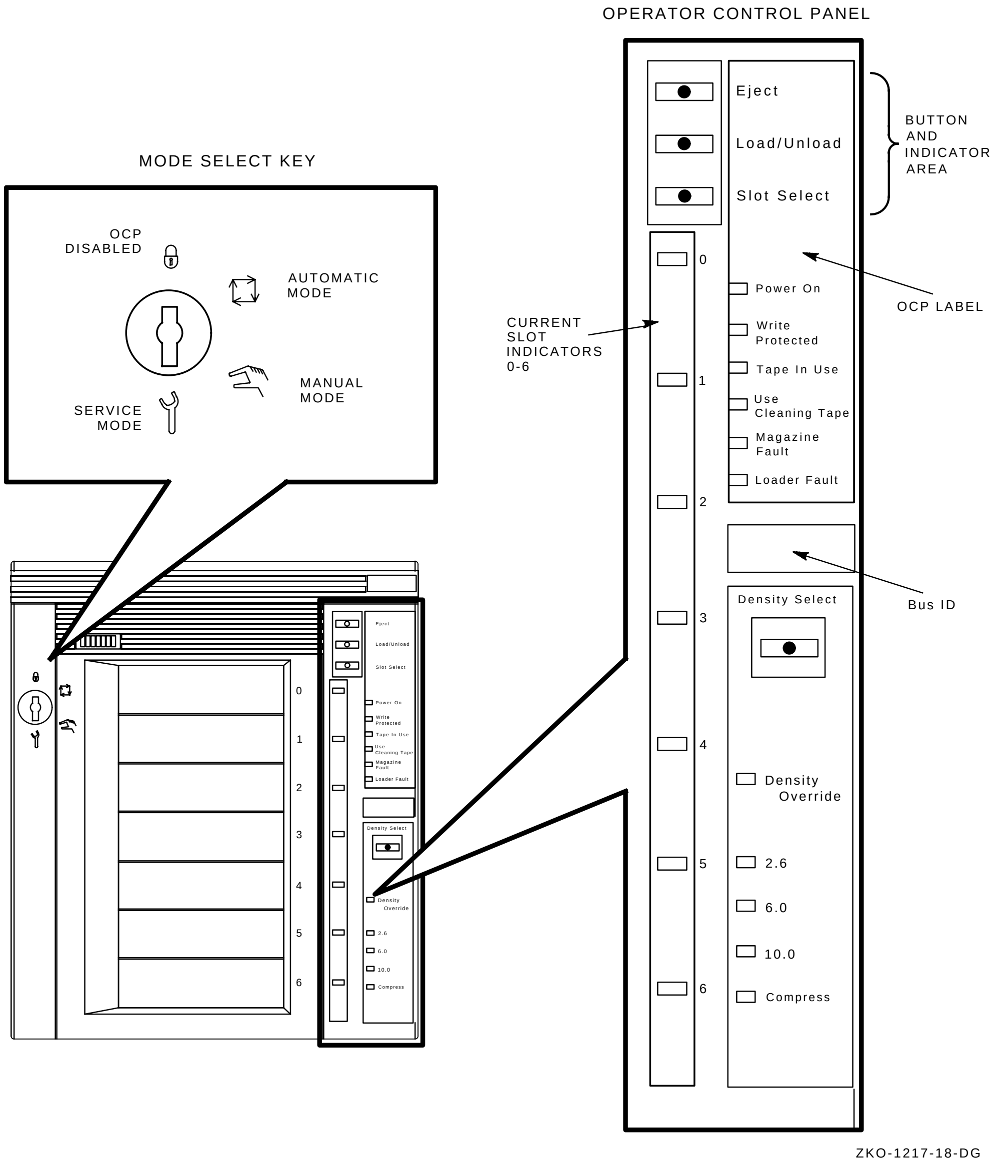


Figure 5-2 *DLT2700 Operator Control Panel*

5.4.2 Automatic Mode

This is the default or normal mode of the DLT2700 subsystem. This mode allows the DLT2700 to load and unload cartridges as needed during backup procedures.

When the user engages the Automatic Mode a SCSI ‘unload’ command is issued, not only is the currently loaded cartridge unloaded from the drive and restored to its position in the magazine, the next higher-numbered cartridge is loaded into the drive.

A SCSI ‘load’ command is unnecessary, except to load the lowest-number cartridge upon inserting the magazine.

When you copy data to the tape, operations stop if one of the following happens:

- Storage capacity of the last tape cartridge is exceeded
- No tape cartridge is in the next sequential slot in the magazine

To lock the DLT2700 subsystem into its normal operating position in the enclosure, but leave the receiver unlocked, set the Mode Select key to Automatic mode.

The following results of setting the Mode Select key to Automatic mode are:

- The OCP pushbuttons are enabled.
- SCSI media changer commands are enabled.
- Cartridge are sequentially loaded by the SCSI ‘unload’ command, but the lowest-numbered cartridge is not automatically loaded upon magazine insertion. Behavior in this mode is modified by the EEPROM parameters ENALDRAUTOLD (1) and DISLDRAUTOLDMC (0), which enable both sequential and random-access functionality.

5.4.3 Manual Mode

Automatic loading and unloading of cartridges does not occur in this mode. You must press the Load/Unload button to move each cartridge. This mode is most useful for, but not restricted to, copying specific files to or from tape. Basically, only the OCP pusbuttons are enabled, as SCSI commands are disabled.

To lock the DLT2700 subsystem into the enclosure, set the Mode Select key to Manual mode.

The following results of setting the Mode Select key to Manual mode are:

- The receiver is unlocked and can be opened.
- SCSI move media commands are disabled
- SCSI load/unload commands are disabled.

Note

During Manual mode, the cartridge returns to the magazine, but the current Slot Select indicator does not advance forward to the next available cartridge.

5.4.4 Service Mode

Service mode allows for servicing procedures.

- SCSI ‘test unit ready’ commands always return not ready

For details on controls and indicators and operation, see the sections after Section 5.5 in this chapter.

5.5 Selecting Density

Section 5.5 describes the loader's density select feature.

Caution

If a prerecorded tape and write from beginning of tape (BOT), all prerecorded data is lost. This includes density changes, since they only occur when writing from BOT.

Ways of Selecting Density

Density selection is only available when you use a CompacTape III tape..

The user can select CompacTape III tape density by using any of the following:

1. On all read operations and all write append operations, the recorded density is the density to be used.
2. On a Write from BOT, the tape density may be changed by:
    - The Density Select button. Using the Density Select button always overrides a host selection.
    - A programmable host selection via your operating system. (The Density Override light is off, indicating automatic or host density selection).
    - Native default density 10.0 GB for the CompacTape III (assuming the Density Select button or the host selection was not used).

How to Select Density

To select density with the DLT2700 using the CompacTape III cartridge:

1. Press the Load/Unload button to load the cartridge into the drive. The yellow Tape in Use light blinks while the tape loads and calibrates.
2. After calibration completes, the yellow Tape in Use light remains lit.
3. The indicator shows the tape's prerecorded density lights, such as 2.6, 6.0 or 10.0.
4. The user can use the loader operator control panel at various times, not just after loading a tape. Density selection is inactive until the write from BOT command is issued. The controller remembers the density selection state until you do one of the following:
    - Change the density selection
    - Eject the magazine from the loader

Density Select Example using a CompacTape III Tape

If you have loaded a CompacTape III tape with a prerecorded 2.6 GB density and you use the Density Select button to select 10.0 GB density, the following should happen:

- The 2.6 light remains lit–density has not changed yet and the steady light indicates recorded tape density
- The 10.0 light blinks–density change is pending
- Density Override lights

When a write from BOT occurs, the following should happen:

- 2.6 turns off
- 10.0 lights steady
- Density Override remains lit

Table 5-1 shows the results of density selection using a CompacTape III tape.

Table 5-1 *Results of Density Selection using a CompacTape III tape*

If …	Then …
You did not select the Density Select button	The lights show the actual density when the tape is reading or writing. The lights are on steady and the Density Override light is off.
You select the Density Select button, and if the actual tape density is the same as the density you selected	The actual density and Density Override light. For example, if the actual tape density is 10.0 GB and the selected tape density is 10.0 GB, then the light next to 10.0 is on.
You select the Density Select button, and if the actual tape density differs from the density selected	1. The light with the actual density is on steady 2. The light with the selected density blinks 3. Density Override lights steady For example, if the actual tape density is 10.0 GB and the selected density is 6.0 GB, the 10.0 lights steady, 6.0 light blinks, and Density Override lights steady.

To select density over the SCSI bus:

1. Do a SCSI MODE SELECT with the density you want. For more details, see Chapter 8.
2. Write data to the tape from BOT.

5.6 Operator Control Panel

The DLT2700 operator control panel (OCP) has 4 OCP pushbuttons and 23 lights (Table 5-2) used with the Mode Select key. See Section 5.4 for information on the Mode Select key and its functions. See Section 5.8 for more details on button and indicator operations.

Table 5-2 lists each button/indicator and its function.

Table 5-2 *DLT2700 Operator Control Pane*

Button/Indicator	Color	Function
Eject button	–	Opens the receiver, allowing access to the magazine for removal and insertion of cartridges. Also unloads the tape from the drive to the magazine, if a tape is inserted.
Eject light	Green	Indicates you can press the Eject button to unload cartridges from the drive to the magazine and open the receiver. Lights when a magazine fault has occurred to indicate Eject is the only function available at that time.
Load/Unload button	–	• Loads the currently selected cartridge into the tape drive • Unloads the cartridge currently in the tape drive • Resets the subsystem if there is a loader fault
Load/Unload light	Green	The user can press the Load/Unload button.
Slot Select button	–	Increments the current slot indicator to the next slot.
Slot Select indicator	Green	The user can press the Slot Select button to move the current slot indicator to the next slot.
Power On light	Green	The DLT2700 is in a known good power state and dc voltages are within tolerance).

Table 5-2 *DLT2700 Operator Control Panel (Cont'd)*

Button/Indicator	Color	Function
Write Protected light	Orange	When on, indicates the cartridge in the drive is write-protected by one of these methods: • The write-protect switch is set to the write-protect position • Host software write-protect qualifiers • When off, indicates that the cartridge in the drive is write-enabled.
Tape In Use light	Yellow	Indicates tape drive activity as follows: • Slow blinking indicates tape is rewinding • Rapid blinking indicates tape is reading or writing • When on steadily, indicates a cartridge is in the drive and the tape is not moving • When off, indicates no cartridge is in the drive
Use Cleaning Tape light	Orange	The read/write head needs cleaning. See Chapter 3.
Magazine Fault light	Red	Indicates a magazine failure.
Loader Fault light	Red	Indicates a loader transfer assembly error or drive error.
Current Slot lights 0-6	Green	Identifies the current slot (see Slot Select button). Each current slot light blinks when its corresponding cartridge moves to or from the drive. Also used with the Magazine Fault or Loader Fault light to show the type of fault (Section 6.6.1 and Section 6.6.2.).
Density Select	Green	Indicates you can choose a density on the OCP

Table 5-2 *DLT2700 Operator Control Panel (Cont'd)*

Button/Indicator	Color	Function
Density Override	Yellow	Indicates tape drive activity as follows: On steady—you selected a density from the front panel. Off (default)—density to be selected by the host (automatic). Blinking—you are in density selection mode.
2.6	Yellow	Indicates tape drive activity as follows: On steady—tape is recorded in 2.6 GB format. Blinking—tape is recorded in another density. You selected this density for a write from BOT.
6.0	Yellow	Indicates tape drive activity as follows: On steady—tape is recorded in 6.0 GB format. Blinking—tape is recorded in another density. You selected this density for a write from BOT.
10.0	Yellow	Indicates tape drive activity as follows: On steady—tape is recorded in 10.0 GB format. Blinking—tape is recorded in another density. You selected this density for a write from BOT.
Compress	Yellow	Indicates tape drive activity as follows: On—Compression mode enabled. Compression can be done in 10.0 GB density only. Off—Compression mode disabled.

5.7 Power-On Process

Caution

Before applying power, verify the DLT2700 is set (see the label on the mini-library rear panel) for the available ac supply voltage.

Table 5-3 explains what happens during each phase of the DLT2700 operation.

Table 5-3 *Loader Power-On Self-Test*

Phase	What Happens
1.	When you power on the DLT2700, the Loader Fault and Power On lights on the loader OCP are on.
2.	One second later, all lights are on. Within 15 seconds, POST of the loader mechanics completes. • If the Magazine Fault and Loader Fault lights turn off, loader POST succeeded. • If the Magazine Fault and Loader Fault lights stay on, loader POST failed.
3.	A few seconds later, the drive controller resets the loader.
4.	Loader POST starts again.

If …	Then POST …
The Magazine Fault and Loader Fault lights turn off and shortly after, all OCP lights but Power On turn off	Passed
The Magazine Fault and Loader Fault lights stay on	Failed

Note

If the Magazine Fault or Loader Fault lights remain on, POST detected an error. See Chapter 6 for error conditions.

5.	The elevator scans the magazine to determine which slots contain cartridges.

Table 5-3 *Loader Power-On Self-Test (cont'd)*

Phase	What Happens
6.	If the subsystem magazine has a cartridge in slot 0, and no cartridge is in the drive, these lights should be on: • Power On • Eject • Load/Unload • Slot Select • Slot 0

5.8 Slot Select, Load/Unload, and Eject Button Functions

The Slot Select, Load/Unload, Eject, and Density Select buttons are OCP pushbuttons. They contain a green light and they are operable only when their corresponding lights are on.

Note

The Load/Unload button has three functions:

- Load
- Unload
- Reset

If a loader fault occurred and the Loader Fault light is on, press Load/Unload to reset the DLT2700.

5.8.1 Selecting a Cartridge

To select a cartridge: press the Slot Select button to advance the slot light to the next available slot. After a successful initialization, the DLT2700 subsystem automatically selects slot 0 and the Slot Select button becomes active. The Load/Unload and Eject lights remain on during slot selection.

5.8.2 Loading the Cartridge

To load the cartridge from the loader into the drive: press the Load/Unload button. Table 5-4 explains what happens after pressing the button.

Table 5-4 *Load/Unload Functions*

Stage	What Happens
1.	The Select Slot, Load/Unload, and Eject lights turn off, and the elevator moves to the selected slot, indicated by the light.
2.	The cartridge is then removed from the magazine and placed in the elevator.
3.	The elevator moves to the drive position and inserts the cartridge into the drive.
4.	The lights remain off until the tape loads to the (BOT).
5.	After the cartridge is loaded into the drive, the Eject and Load/Unload lights turn on, and the corresponding buttons are enabled. The Slot Select light remains off.

5.8.3 Unloading the Cartridge

Caution

Do not press the Load/Unload button until backup or other tape operations are stopped at the terminal. Doing so can result in operation failure and drive unavailability.

Note

The Load/Unload light must be on before you press the Load/Unload button to load or unload a cartridge.

If …	**Then …**
You want to unload the cartridge from the drive	Press the Load/Unload button. • The Select Slot, Load/Unload, and Eject lights turn off. • The cartridge unloads from the drive into the magazine. • However, automatic operation now stops and the Select Slot operation does not move in increments. The lights turn on once the cartridge is returned to the magazine.
The Loader Fault light is on, showing a malfunction	Press the Load/Unload button to reset the subsystem and try to clear the error.

5.8.4 Opening the Receiver

The Eject button opens the receiver for insertion or removal of the magazine. The button is disabled when the Mode Select key is in the OCP Disabled position. The Eject button can also be used to *unload* a tape from the drive.

When …	Then …	You should …
A cartridge is not in the drive	The Slot Select, Load/Unload, and Eject lights are on before any operation begins.	Press the Eject button to turn off all lights. The elevator then returns to its home position and the receiver opens.
A cartridge is in the drive	The Eject and Load/Unload lights are on before the operation begins	Press the Eject button to turn off both lights and the cartridge unloads from the drive and moves back into the magazine. The receiver then opens to allow access to the magazine.

Result: In both situations, once the receiver is closed again, a magazine scan begins, and the lights turn back on when the scan completes.

5.9 Magazine

The front of the magazine has numbers, 0 through 6, that indicate the number of the slot.

Note

Insert and remove all cartridges at the *front* of the magazine.

5.9.1 Inserting a Cartridge into the Front of the Magazine

To simplify cartridge insertion: place the magazine on a flat surface with the slots facing you (Figure 5-4). Each slot is numbered to ensure you are inserting the cartridge correctly in the front of the magazine. Usually, cartridges are inserted into consecutive slots.

To insert a cartridge into the magazine:

1. Grasp the cartridge with the write-protect switch on the right side facing you (Figure 5-3).
2. Set the cartridge's write-protect switch to the desired position.

If you want to …	**Then …**
Write to the tape	Slide the switch to the right (orange indicator is not visible)
Write-protect the tape	Slide the switch to the left (orange indicator is visible)

3. Insert the cartridge (Figure 5-4) by pushing it into the slot until you hear a click. A small metal tab holds the cartridge in place.

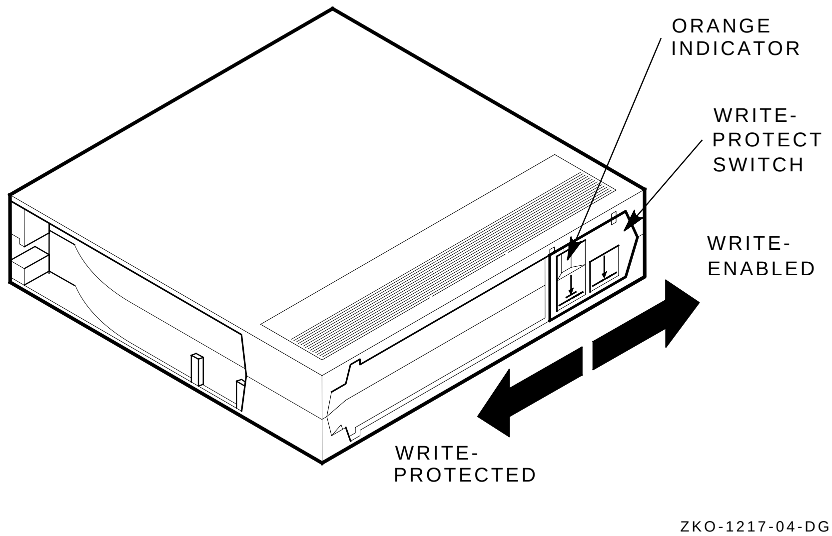


Figure 5-3 *Write-Protect Switch on a Cartridge*

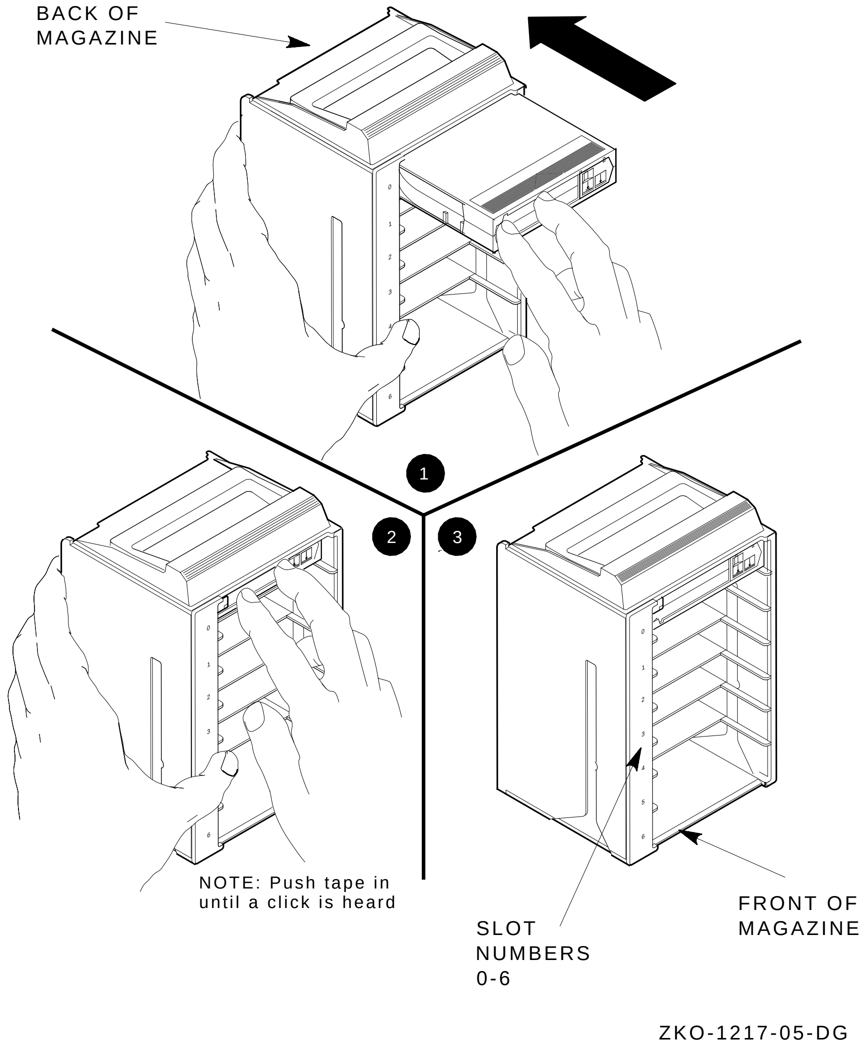


Figure 5-4 *Inserting a Cartridge into the Magazine*

5.9.2 Removing a Cartridge from the Magazine

To remove a cartridge from the magazine: at the front of the magazine press in on the cartridge (Figure 5-5) until it stops and you hear a click. Then, release. The slot has a spring-release action.

Note

Never apply labels to the top or bottom of tape cartridges. Doing so can cause cartridge jams in the DLT2700 subsystem. Use the space on the front of the cartridge for labels.

5.9.3 Removing the Magazine from the Receiver

To remove the magazine from the receiver, first ensure:

1. The Power On light is on (Figure 5-2).
2. The Eject light is on. (It must be on before you can press the Eject button.)

Then:

1. Press the Eject button (Figure 5-2) to open the receiver. If a tape is loaded in the drive, pressing the Eject button also causes the tape to unload.
2. Grasp the receiver after it opens (Figure 5-6), and gently pull it forward to access the magazine.
3. Grasp the magazine's handle only to lift the magazine out of the receiver.

5.9.4 Installing the Magazine into the Receiver

To install the magazine into the receiver:

1. Slide the magazine down into the receiver (Figure 5-6) while holding the magazine by the handle. Since the magazine is slotted, you can restore it in the correct orientation only.
2. Push the receiver closed.
3. Observe that the receiver is fully closed in the DLT2700 subsystem before proceeding.

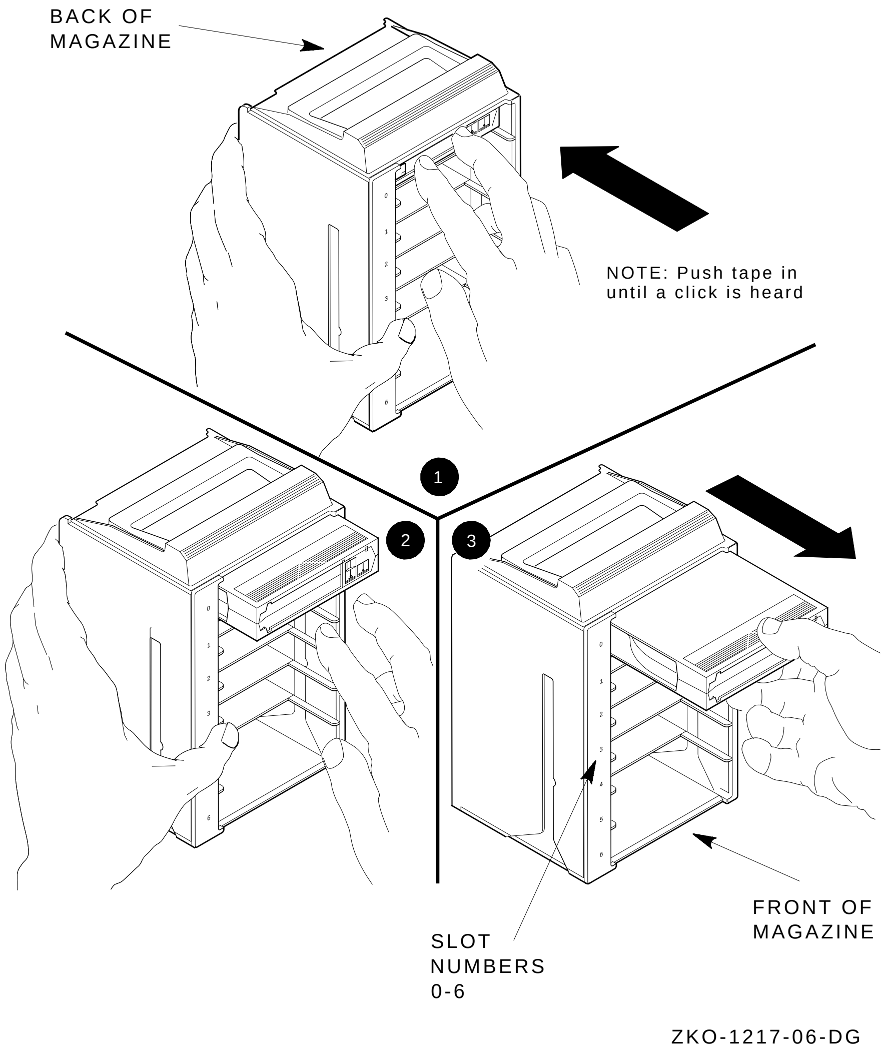
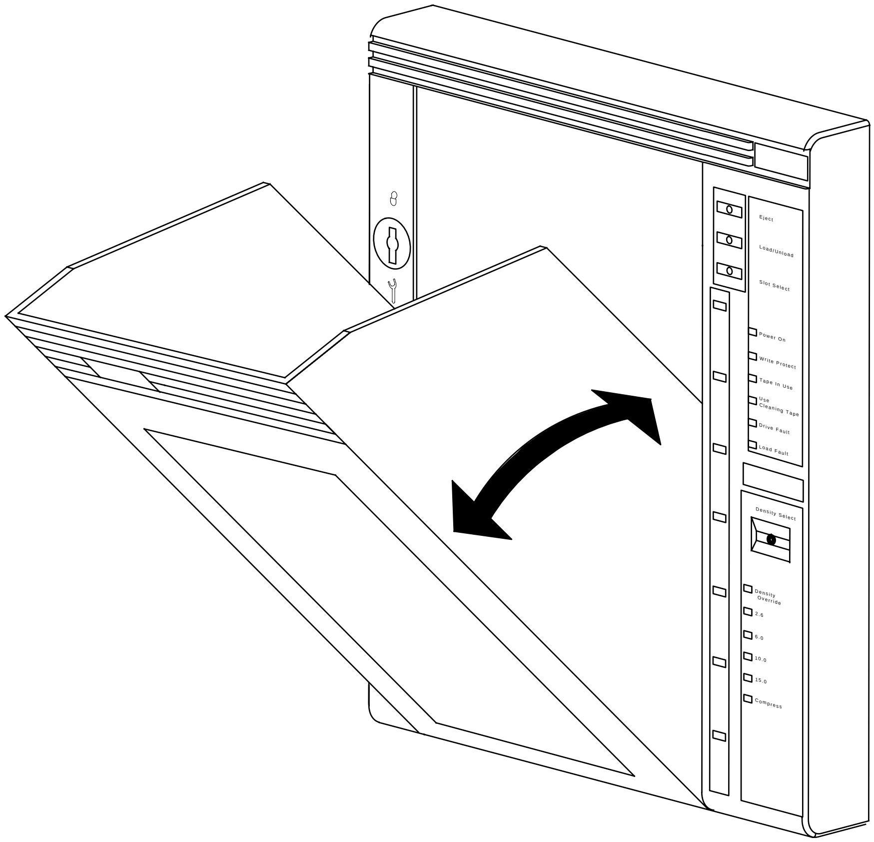


Figure 5-5 *Removing a Cartridge from the Front of the Magazine*



ZKO-3135-04-DG

Figure 5-6 *Receiver Opened*

Chapter 6

Troubleshooting Guide for the DLT2500/DLT2700 Mini-Library

6.1 In This Chapter

Chapter 6 includes the following main topics and sections:

Topic	Section
Conditions Necessary for Button Operation	6.2
Backup Operation Failure	6.3
Avoiding Basic Problems	6.4
Error Conditions : DLT2500	6.5
DLT2700	6.6
Power Problems	6.7

6.2 Conditions Necessary for Button Operation

Be sure to review information in the previous chapters to ensure you are correctly operating the DLT2500/DLT2700 mini-library.

Before you press the Slot Select, Load/Unload, or Eject button on the DLT2500/DLT2700 OCP, check for the conditions listed in Table 6-1 and ensure the:

- Power On indicator is on
- Receiver is closed
- Mode Select key is *not* set to OCP Disabled

Pressing these buttons has no effect if their indicators are off.

Note

Do not press the Load/Unload button to abort any function of the DLT2500/DLT2700 subsystem. Press [Ctrl/Y] or [Ctrl/C] instead.

See Chapter 4 for more information on the functions of the DLT2500 OCP buttons.

Table 6-1 *DLT2500 OCP Button Conditions*

If you want to …	First, ensure the …	Then you can press this button …
Select another slot in the magazine	• Magazine contains at least two cartridges • LDR RDY displays	Select
Load the selected cartridge into the tape drive	• Magazine contains at least one cartridge • LDR RDY displays	Load/Unload
Return the selected cartridge to its original slot in the magazine	DRV RDY displays	Load/Unload
Clear a magazine or loader error	ERR MAG or ERR LDR displays	Load/Unload
Open the door or unload the cartridge from the drive and open the door	LDR RDY displays	Open

See Chapter 5 for more information on the functions of the DLT2700 OCP buttons.

Table 6-2 *DLT2700 OCP Button Conditions*

If you want to …	First ensure the …	Then you can press this button …
Select another slot in the magazine	• Magazine contains at least two cartridges • Slot Select light is on	Slot Select
Load the selected cartridge into the tape drive	• Magazine contains at least one cartridge • Load/Unload light is on	Load/Unload
Return the selected cartridge to its original slot in the magazine	Load/Unload light is on	Load/Unload
Clear a magazine or loader fault	• Load/Unload light is on • Magazine Fault or Loader Fault light is on	Load/Unload
Open the receiver, or unload the cartridge from the drive and open the receiver	Eject light is on	Eject

6.3 Backup Operation Failure

Some manual operations, if not performed correctly, may cause backup operations to fail during BACKUP:

- Loading write-protected CompacTape III cartridges when executing write operations
- Selecting the incorrect cartridge slot from which to initialize operations

6.4 Avoiding Basic Problems

Follow these guidelines when you operate the DLT2500/DLT2700 subsystem to avoid basic problems:

- Use CompacTape III cartridges.
- Check the tape leader in the cartridge by lifting the cartridge latch that opens the door to expose the leader. Be sure the leader is in the same position as the one shown in Figure 6-1.

Caution

Do not touch the exposed magnetic tape. If the tape leader is not in the correct position, use a new cartridge.

- Be sure the receiver is fully closed and the current slot indicator is on for the starting cartridge.
- Be sure *no* slots in the magazine are empty between the starting cartridge and the expected completion cartridge.

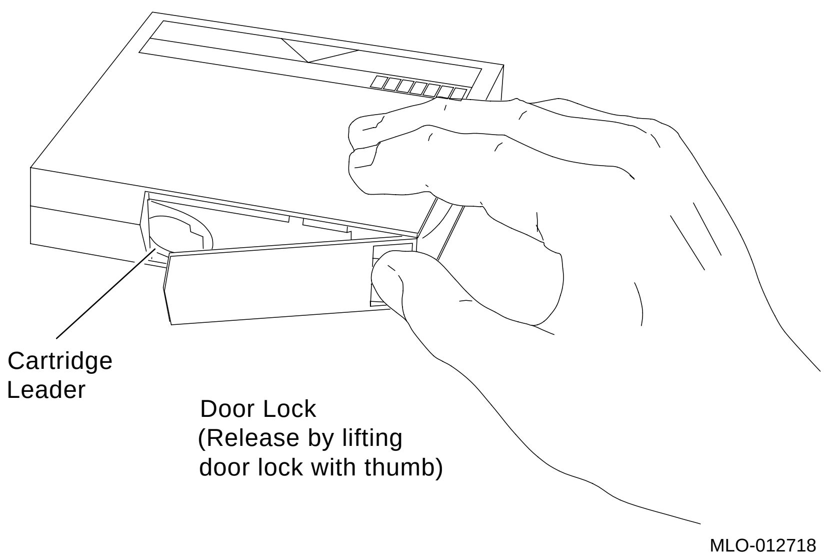


Figure 6-1 *Opening the Cartridge Door to Check the Tape Leader*

6.5 DLT2500 Error Conditions

Error indications fall into these main categories:

- Magazine Error
- Loader Error
- Drive Error
- Controller Error
- Unknown Error

6.5.1 DLT2500 Magazine Error

The ERR MAG message tells you the status of cartridges reported by the loader and drive is inconsistent. In some magazine errors, the mini-library retries the error three times before showing failure. All magazine errors cause the ERR MAG message to display.

6.5.1.1 DLT2500 Clearing a Magazine Error

When you press the Open button, the mini-library attempts to clear the error. The door opens to let you remove the magazine. Verify that cartridges are inserted securely into the magazine and the magazine is not defective.

If you still cannot clear the error, call your service representative.

6.5.2 DLT2500 Loader Error Description

The ERR LDR message tells you the mini-library detected an error in the loader transfer assembly. In some loader transfer assembly errors, the mini-library retries the error three times before showing failure. All loader errors cause the ERR LDR message to display.

6.5.3 DLT2500 Drive Error Description

The ERR DRV message tells you the mini-library detected an error in the tape drive. In some drive errors, the mini-library retries the error three times before showing failure. All drive errors cause the ERR DRV message to display.

6.5.4 DLT2500 Controller Error Description

The ERR CTL message tells you the mini-library detected an error in the controller. In some controller errors, the mini-library retries the error three times before showing failure. All controller errors cause the ERR CTL message to display.

6.5.5 DLT2500 Unknown Error Description

The ERR UNK message tells you the mini-library detected an error of unknown origin. In some unknown errors, the mini-library retries the error three times before showing failure.

6.5.5.1 DLT2500 Clearing a Loader, Drive, Controller, or Unknown Error

When you press the Load/Unload button, the mini-library attempts to clear the error. When you press the Open button, the door opens to let you access the magazine.

If you still cannot clear the error, call your service representative.

6.6 DLT2700 Error Conditions

Error indications fall into two main categories:

- Magazine Fault – In most cases, this is an operator-correctable condition, indicated when the Magazine Fault light is on. If you cannot resolve the fault, call your service representative.
- Loader Fault – This condition most likely requires service from a service representative. It is indicated when the Loader Fault light is on.

6.6.1 DLT2700 Magazine Fault Cases

A magazine fault can occur during any of the following cases:

1. A cartridge has been removed from the magazine incorrectly.

Note

This can only occur if the loader has been opened in service mode and cannot occur under normal operation.

2. A cartridge was manually unloaded from the drive.
3. A cartridge that was loaded into a drive by the loader was manually unloaded and put back into the magazine.
4. A cartridge was manually inserted into the drive.

When these conditions are present, the Magazine Fault light turns on, indicating a situation that can be corrected by the operator. Eject is also on to inform you that this is the only function available at this time.

6.6.1.1 Detecting Cases 1, 2, and 3

The user can tell these cases have occurred when the Magazine Fault light and slot lights 0 and 5 are on.

Caution

Never remove a cartridge from the magazine by moving the metal tab in front of the cartridge. This is the main source of magazine faults. Use the proper procedure, Chapter 5.

To clear a magazine fault caused by cases 1, 2, and 3:

1. Press the Eject button to open the receiver.
2. Remove the magazine and check for a metal tab over an open slot. This is the slot from which the cartridge was removed.

If …	Then …
A metal tab is found over an open slot	1. Reinsert the missing cartridge properly by pushing the tab aside and insert cartridge until it snaps into place. If no cartridge is needed in this slot, push one into the slot and then remove it according to normal procedure (Chapter 5). This step is critical to avoid more magazine faults. 2. Insert the magazine into the receiver. 3. Close the receiver.

6.6.1.2 Detecting Case 4

The user can tell this case occurred when the Magazine Fault light and slot lights 0 and 6 are on. This is the only time slot lights 0 and 6 are on for a magazine fault. To clear a magazine fault caused by case 4:

1. Press the Eject button to open the receiver.
2. Close the receiver to clear the Fault light.
3. Press the Load/Unload button; the cartridge loads, but is not removed from the drive. The Magazine Fault light comes on, and the receiver opens. The service person must remove the magazine, reach in and lift the handle on the front of the drive, and pull out the cartridge.

Note

Slot 0 lights in all error conditions to indicate an error occurred. It is not a Slot Select indicator in this case.

After you clear the error try loading and unloading cartridges to verify operation.

6.6.2 DLT2700 Loader Fault Description

A loader fault indicates the DLT2700 detected a fatal error in the loader transfer assembly or in the tape drive. In some loader transfer assembly errors, the subsystem retries the error three times before indicating failure. All loader faults cause the Loader Fault light and an associated subcode to light.

Loader Fault indicates errors in the loader transfer assembly, controller module, or drive. The suspected fault location is indicated by the following slot lights:

- Slots 4 and 0—a controller module
- Slots 5 and 0—a loader transfer assembly
- Slots 6 and 0—drive

Note

Error lights do not blink. During hardware failures, the controller module determines action.

6.6.2.1 Clearing a DLT2700 Loader Fault

When a loader fault occurs, the Load/Unload and Eject lights are on. When you press the Load/Unload button, the DLT2700 attempts to clear the error. When you press Eject, the receiver opens to let you access the magazine.

6.7 Power Problems

If the Power On light is not on, or your system does not recognize the DLT2500/DLT2700 subsystem:

- Ensure the power plug is secure.
- Verify with your system manager that the subsystem configuration is correct.

7

Firmware Update (From Tape)

7.1 In This Chapter

Chapter 7 includes the following main topics and sections:

Topic	Section
DLT2000 Firmware Update Overview	7.2
Creating a "Firmware Update Tape"	7.3
Firmware Update Procedure	7.4

7.2 DLT2000 Firmware Update Overview

Through the use of the front panel the DLT2000 Cartridge Tape Subsystem family can automatically update the controller firmware directly from a tape containing the appropriate information.

The user places the subsystem into firmware Update Mode via the front panel and then simply load a tape that includes the DLT2000 firmware image file.

The subsystem automatically reads and verifies the tape information has a valid DLT2000 firmware image. If the image data passes all the verifications, the image data is installed into the controller's nonvolatile code memory.

This chapter details the firmware update procedure.

7.2.1 Before Doing the Procedure

Before doing the procedure, remember:

Caution

During the firmware update, when the new image is actually being programmed into the FLASH EEPROMs, a power fail (but not BUS RESET) causes the controller module to be unusable. When doing a firmware update, take reasonable precautions to prevent a power fail.

7.2.1.1 Updating Firmware on a Standalone System

The user can update the subsystem, even when the subsystem is not attached to a SCSI bus, that is, a standalone system. However, to do an update, the Power-On Self-Test (POST) must pass first, and to pass, POST needs a properly terminated bus.

The single-ended DLT2000 controller module has active terminators. Note the jumper covering the two pins labeled on the etch: TRM PWR/TRM ENB.

The differential DLT2000 controller module does not have on-board termination.

To do a firmware update on a standalone system:

1. Find the TRM PWR/TRM ENB connector on the left side of the DLT2000 drive (Figure 7-1, number ❶).

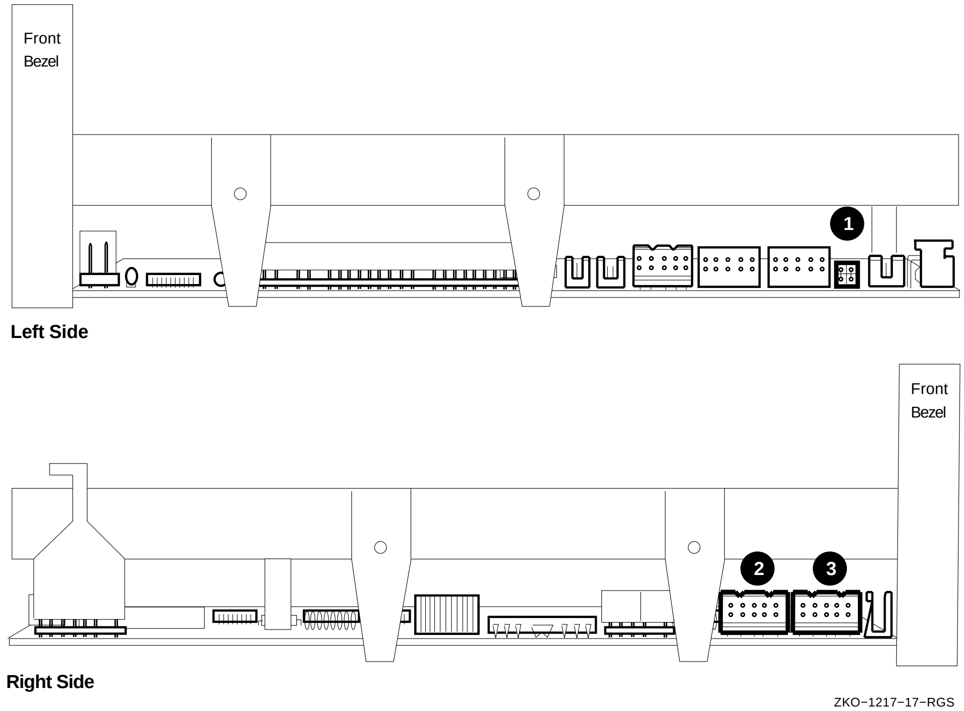


Figure 7-1 *DLT2000 Subsystem Connectors*

❶ TRM PWR/TRM ENB Connector

❷ SCSI ID Connector

❸ Loader Connector

2. Ensure the TRM PWR/TRM ENB jumpers are in position (Figure 7-2, number ❹).

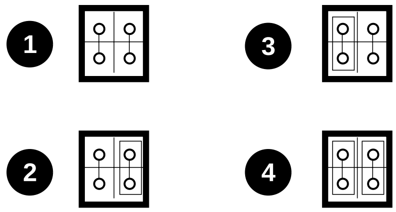


Figure 7-2 *Jumper Settings for TRM PWR/TRM ENB Connector*

❶ No Term Power/Disable Active Termination	❸ Term Power/Disable Active Termination
❷ No Term Power/Enable Active Termination	❹ Term Power/Enable Active Termination

From the time the tape is inserted and the drive handle is closed, updating the firmware takes from 2 to 3 minutes.

7.3 Creating a "Firmware Update Tape"

To do the firmware update, you must have a CompacTape III cartridge with a copy of the firmware image. This image must be byte-written onto the tape in a 4K block format. The image must be "copied" onto the tape instead of using the backup utility.

7.3.1 On UN*X Systems

The FTP utility can be used to transfer the binary firmware image file onto the UN*X system. Be sure to specify "type image" before doing the "get" or "put." Otherwise, extra characters may be added to the file, causing the image file to be invalid. The image file should be exactly 1152*512 bytes in size.

When making the update tape, copy the image file to the tape media using a block size of 4096, that is dd, ltf, and so forth. The tape has to be uncompressed.

7.4 Firmware Update Procedure

Section 7.4 describes the procedure for updating the firmware (code) of the DLT2000 subsystem controller. The update is done from a cartridge that stores the firmware image. Firmware update from the host is also supported. See the section on the SCSI WRITE BUFFER command in Chapter 8 for details.

Firmware updates are supported on the DLT2000 with and without the media loader. The steps for performing the update are similar for each. To update the firmware with the:

- Drive only configuration, see "Updating the Firmware on DLT2000 (Drive Only Configuration)"
- Drive and loader configuration, see "Updating the Firmware on the DLT2500 (Drive and Loader Configuration)"
- Drive and loader configuration, see "Updating the Firmware on the DLT2700 (Drive and Loader Configuration)"

Caution

Never turn off power if you think the firmware is being updated. This can damage the controller.

7.4.1 Updating the Firmware on DLT2000 (Drive Only Configuration)

1. Get or make a CompacTape III with the firmware image of the desired revision level copied to it.
2. Put the DLT2000 subsystem into firmware update mode. To do this:
   a. Remove any cartridge that is in the target DLT2000 drive and close the handle (down position).
   b. Press the Unload button on the drive front panel and hold the button (about 6 seconds) until the Write Protect indicator blinks. This means the DLT2000 subsystem has recognized your request for firmware update mode and is waiting for the sequence to complete.

If the Write Protect indicator does not blink, check that:

1. POST passed
2. The drive is unloaded
3. The drive handle is in the down position

c. Then, release the Unload button and press the button again within 4 seconds. The second press should take less than 1 second.

d. The Tape in Use and the Write Protect indicators blink, showing the tape subsystem recognizes the firmware update mode has been selected.

e. If selecting the firmware update mode is not successful (for example, pressing the button the second time takes longer than one second) the Write Protect indicator should stop blinking within several seconds.

   Try the procedure again. If the drive and controller are not properly communicating, you cannot select firmware update.

3. Once you have selected the firmware update mode, insert a cartridge into the drive, which:

   a. Temporarily turns off the Tape in Use and Write Protect indicators.

Note

Calibration and directory processing cause the tape to move for a few minutes before data is actually read.

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   b. Automatically reads the cartridge

   c. Examines the data

   d. Verifies the data is a valid DLT2000 firmware image

   Firmware update mode is automatically cleared at this point. If the firmware image is valid and:

   - If the drive code is up-to-date, the drive code does not go through an update.
   - If the drive code is *not* up-to-date, the drive code goes through an update, taking 2 to 3 minutes.

4. While the drive code goes through the update, the Write Protect and Tape in Use indicators flash alternately.
5. When the drive code update is complete, the drive resets, and goes through Power-On Self-Test (POST). The process waits until the tape is reloaded at beginning of tape (BOT).
6. If the firmware image is valid, the controller's flash EEPROM memory is automatically updated with the new firmware image. The Write Protect and Tape in Use indicators flash again during the controller firmware update.

7.4.1.1 Interpreting the Results (DLT2000 Code Update)

Two possible results can occur:

- The firmware update cartridge is unloaded: this means a successful update.

  On the DLT2000, the media is placed into the cartridge, the door is unlocked, and the green Operate Handle indicator is turned on.

- The firmware update cartridge is *NOT* unloaded: this means the update was *unsuccessful*.

  The subsystem should still be usable, but this depends on why the update failed. Reasons for failure could be:

  1. Power failure
  2. Bad image on the tape
  3. Broken Flash EEPROMs

Table 7-1 gives additional details.

Table 7-1 *Results (DLT2000 Code Update)*

If...	Then...
The image is valid	1. The flash EEPROM containing the current firmware is erased. 2. The new image is programmed in. The subsystem completes the update in about 2 minutes. Then: • The tape drive resets itself. • POST takes place. • The drive automatically unloads the tape cartridge containing the firmware image, so you can remove the cartridge. This shows a successful firmware update.
1. The tape is NOT a valid firmware update tape. 2. The tape does not contain a valid image	No update is attempted. The Write Protect and Tape In Use indicators do not blink. The drive resets and the tape stays loaded to signal the firmware update was unsuccessful.
The tape contains a valid image, but for some reason the reprogramming flash memory fails	The controller is probably unusable and needs to be replaced. The tape drive resets itself and reruns POST, which fails if flash memory does not contain a valid image.

Caution

Code update can appear finished, but in fact it is still processing. Wait 20 seconds for the green light to appear to ensure the code update has been completed.

7.4.2 Updating the Firmware on the DLT2500 (Drive and Loader Configuration)

1. Get or make a CompacTape with the code image of the specified revision level copied to it.
2. Put the mini-library into code update mode. To do this:
   a. With the LDR RDY message displaying, press the OCP Open button to open the door and remove the magazine. Then, close the door.
   b. Remove all cartridges from the magazine and install the code update cartridge into the magazine.
   c. Press and hold the Display Mode button (about 5 seconds) until the SCSI ID SEL message displays.
   d. Press and hold the Load/Unload button until the SCSI ID SEL message starts to flash. Immediately release the button, and then press it again. The CODE UPDATE MODE message now displays.
3. Press the Open button two times to open the magazine door. Load the magazine with the code update tape into the mini-library and close the door. Wait until the elevator stops scanning the magazine. Press the Load/Unload button to load the code update tape into the tape drive.

If …	Then …
The DLT2500 code revision is the same revision as that of the update tape	The DLT2500 code does not go through an update.
The DLT2500 code revision is *not* the same revision as that of the update tape	The DLT2500 code goes through an update, taking about 5 minutes.

4. During a DLT2500 code update, the drive:
   a. Automatically reads the tape.

NOTE

Calibration and directory processing cause the tape to move for a few minutes before data is actually read.

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   b. Examines the data.
   c. Verifies the data is a valid DLT2500 code image. When the drive code update completes, the controller's flash EEPROM memory is updated with the new code image.
   d. Resets and goes through POST, and the code update tape cartridge returns to the magazine. The LDR RDY message displays.
5. If the code update succeeds, the mini-library resets itself. A magazine scan takes place.

7.4.2.1 Interpreting the Results (DLT2500 Code Update)

The following results can occur:

Table 7-2 *Results (DLT2500 Code Update)*

If …	This means …	And you should …
The code update cartridge unloads from the drive and loads into the magazine slot from which it came.	The update *succeeded.* The controller's flash EEPROM memory is updated with the new firmware image.	Begin operating the mini-library.
The code update cartridge does *NOT* unload from the drive and load into the magazine.	The update *failed*. The drive may reset and the ERR UNK message may display. The mini-library should still be usable, but this depends on why the update failed. The reasons for failure could be:	

Table 7-2 *Results (DLT2500 Code Update) Cont'd*

If …	This means …	And you should …
	• The code update cartridge contains a corrupted image file or the file is built improperly.	1. Press the Unload button to unload the tape cartridge from the drive. 2. Press the Open button to open the magazine door. 3. Remove the magazine and close the door. The mini-library does an elevator scan. 4. Open the door again. The message LDR RDY displays. 5. Verify you have the valid image for your drive type (variant) in the magazine. Ensure the image copied to the tape cartridge is using a block size of 4096. 6. Try the code update procedure again using the valid tape image. If you still cannot do the update, call your service representative.

Table 7-2 *Results (DLT2500 Code Update) Cont'd*

If …	This means …	And you should …
	• The tape cartridge with the valid update image is not readable.	1. Press the **Unload** button to unload the tape cartridge from the drive. 2. Press the Open button to open the magazine door. 3. Remove the magazine and close the door. The mini-library does an elevator scan. 4. Open the door again. The message LDR RDY displays. 5. Rebuild the valid image on a good cartridge. 6. Try the code update procedure again using the valid tape image. If you still cannot do the update, call your service representative.
	• A power failure occurs during the code update. The drive may be unusable.	Try unloading the cartridge from the drive, as described in this table, to do the code update again. If you still cannot do the update, call your service representative.

Table 7-2 Results (DLT2500 Code Update) Cont'd

If …	This means …	And you should …
	• A controller failure occurs. The drive is most likely unusable and needs to be replaced.	Turn off mini-library power and then on again. If you still have a drive controller failure, see your service representative.

7.4.3 Updating the Firmware on the DLT2700 (Drive and Loader Configuration)

1. Get or make a CompacTape with the firmware image of the desired revision level copied to it.
2. Put the DLT2700 subsystem into firmware update mode. To do this:
   a. Remove any magazine in the DLT2700 loader receiver and close the receiver.
   b. Put the Mode Select key in Service Mode (wrench icon).
   c. Press the Load/Unload button on the operator control panel (OCP) and hold the button (about 6 seconds) until the Write Protect indicator blinks. This means the DLT2700 subsystem has recognized your request for firmware update mode and is waiting for completion of the sequence.

      If the Write Protect indicator never blinks, check that:

      1. POST succeeded
      2. The drive is unloaded
      3. The drive handle is in the down position
      4. No magazine is in the loader
      5. The receiver door is closed
      6. The Mode Select key is in Service Mode

   d. Then, press and release the Unload button and press the button again within 4 seconds. The second press should be less than 1 second.

e. The Tape in Use and the Write Protect indicators blink, showing the subsystem recognizes the firmware update mode has been selected.

f. If selecting firmware update mode is not successful (for example, because of not pushing the Unload button properly the second time), the Write Protect indicator should stop blinking within several seconds. Try the procedure again.

3. Once you have selected the firmware update mode, press the OCP EJECT button twice, which causes the receiver door to open. The Write Protect and Tape In Use indicators stop blinking, even though the subsystem is still in Update mode.
4. Place a magazine with the Firmware Update Tape in the first slot in the loader receiver and close the receiver. (The remainder of the update procedure goes faster if the magazine contains only the firmware update cartridge. But the procedure still works if other cartridges are present.)
5. Press the Load/Unload button to load the Firmware Update Tape into the drive.
6. Once you have selected the firmware update mode, the drive:

a. Automatically reads the tape

Note

Calibration and directory processing cause the tape to move for a few minutes before data is actually read.

b. Examines the data

c. Verifies the data is a valid DLT2700 firmware image

Firmware update mode is automatically cleared at this point. If the firmware image is valid and:

d. If the drive code is up-to-date, the drive code does not go through an update.

e. If the drive code is *not* up-to- date, the drive code goes through an update, taking 2 to 3 minutes.

f. While the drive code goes through the update, the Write Protect and Tape in Use indicators flash alternately.

g. When the drive code update is complete, the drive resets, and goes through Power-On Self-Test (POST). The process waits until the tape is reloaded at beginning of tape (BOT).

h. If the firmware image is valid, the controller's flash EEPROM memory is automatically updated with the new firmware image.

i. Whether the firmware update is successful, the subsystem resets itself. A full, extended scan of the loader takes place. The scan goes quickly if the firmware update cartridge was the only tape cartridge in the magazine. If six other cartridges are present, the scan takes an extra minute or more.

7.4.3.1 Interpreting the Results (DLT2700 Code Update)

Two possible results can occur:

- The firmware update cartridge is unloaded: this means a successful update.

  On the DLT2700, the cartridge is unloaded from the drive and into the magazine slot from which it came. If another cartridge is in the magazine, that next cartridge loads into the drive.

- The firmware update cartridge is *NOT* unloaded: this means the update was *unsuccessful*.

The subsystem should still be usable, but this depends on why the update failed. Reasons for failure could be:

1. Power failure
2. Bad image on the tape
3. Broken flash EEPROMs

Table 7-3 gives additional details.

Table 7-3 *Results (DLT2700 Code Update)*

If …	**Then …**
The image is valid	1. The Flash EEPROM containing the current firmware is erased. 2. The new image is programmed in. The subsystem completes the update in about 2 minutes. Then: • The tape drive resets itself. • POST takes place. • The drive automatically unloads the tape cartridge containing the firmware image so you can remove the cartridge. This shows a successful firmware update.
The tape is NOT a valid firmware update tape	No update is attempted. Write Protect and Tape In Use do not blink.
The tape contains a valid image, but for some reason reprogramming of Flash memory fails	The controller is probably unusable and needs to be replaced. The tape drive resets itself and reruns POST, which fails if the Flash memory does not contain a valid image.

Caution

Never turn off power if you think the firmware is being updated. Doing so can damage the controller.

8

DLT2000 SCSI Interface

8.1 Overview

This chapter details the SCSI Protocol features the DLT2000 implements.

The following sections do not fully reiterate the ANSI SCSI specification, but describes the supported commands, messages, and options supported, and the error recovery procedures.

8.2 General SCSI Bus Operation

8.2.1 Data Transfer

The DLT2000 supports asynchronous and synchronous data transfers. The product has differential and single ended versions. Odd parity is generated during all information transfer phases where the device writes data to the SCSI bus, and checked during all information transfer phases where data is read from the bus. Parity checking can be disabled. Refer to Chapter 2 for details.

Note

The SCSI specification referrers to mini-libraries as “medium changers” where as Quantum uses the term “min-libraries” throughout this manual.

The DLT2000 supports a maximum block size of 1 Byte to 16 MBytes.

Disconnects from the SCSI bus will be done at regular intervals during a data transfer. This allows other devices to access the bus. This disconnecting is configurable by use of the Disconnect-Reconnect Mode Parameters page.

8.2.2 Initiator/Target Operation

The DLT2000 does not act as an initiator on the SCSI bus. Therefore, the device will not do any of the following:

- Generate unsolicited interrupts to the host
- Initiate its own SCSI commands
- Assert bus reset

8.2.3 SCSI IDs and Logical Unit Numbers (LUNs)

The DLT2000 with optional medium changer has two logical units. The tape drive will always appear as LUN 0. The medium changer defaults to appearing as LUN 1, but may be configured via the MODE SELECT command to any LUN from 1 to 7. Refer to MODE SELECT section in this chapter.

Unsupported LUNs will be treated as follows: If the LUN specified in the IDENTIFY message is invalid, the DLT2000 shall accept the Command Descriptor Block (CDB). There are three cases of what happens next:

1. If the command is INQUIRY, the target shall return the INQUIRY data with the peripheral qualifier set to 011, indicating that the target will never support the LUN in question.
2. If the command is REQUEST SENSE, the target shall return sense data. The sense key shall be ILLEGAL REQUEST, with an additional sense code of INVALID Logical Unit Number.
3. For any other command, the target shall terminate the command with CHECK CONDITION status, and generate the above Sense Data.

8.2.4 Unit Attention Condition

Queued Unit Attentions are implemented on this device, and are maintained separately for each valid LUN for each Initiator. Unit Attentions will be created in the following circumstances:

- Power on
- BUS Reset
- Bus Device Reset message
- When the media may have changed asynchronously
- Another initiator changed the Mode Parameters
- A firmware (microcode) update has completed

Two queued Unit Attentions are not unusual. For example, if a unit is powered up and a cartridge is loaded, Power Up and Not-ready to Ready Transition Unit Attentions are created. Due to a limited number of Unit Attention buffers, if an initiator does not clear Unit Attentions queued for it, at some point the tape device will stop generating new Unit Attentions for that I-L combination (but existing ones will be left queued).

A LOAD command will not generate a Unit Attention for the initiator that issued the command, since the transition to ready is synchronous.

8.2.5 Behavior Around Power-On and SCSI Bus Reset

- All device SCSI lines shall go to high impedance when the DLT2000 is powered off.
- The DLT2000 will not generate any spurious signals on the SCSI bus at power-on.
- Within 5 seconds of power on, and within 250 milliseconds (typically under 4 ms) after a Bus Reset, the DLT2000 will respond to SCSI bus selections and return appropriate, normal, responses. Tape motion commands will be returned with Check Condition status, Sense Key Not Ready, until the media has been made ready.
- The Hard Bus Reset option is implemented.
- Cached write data are flushed to the media upon bus reset.
- The media is rewound to BOP (Beginning of Partition, i.e. Beginning of Tape).

The DLT2000 will be able to recognize multiple bus resets in succession and bus resets of arbitrarily long duration. It will recover within the time limits specified above, following the last bus reset.

8.2.6 Data Cache and Tape Write Interaction

The DLT2000 contains a data cache that buffers blocks (records) until they are written. This section defines specific times that blocks shall be written to tape. A Mode Select parameter allows the data cache to be disabled (unbuffered mode). In this mode, every WRITE command will cause the data to be written to the media before the STATUS byte and the COMMAND COMPLETE message is returned to the host. Unbuffered mode is *not* recommended due to the poor performance that will result.

NOTE

Unbuffered mode is not recommended due to the poor performance that will result.

The write data cache shall be written (flushed) to the media under the following circumstances:

- When WRITE FILEMARKS command is issued with the immediate bit is set to zero.
- When a WRITE 0 FILEMARKS command is issued.
- Data in the cache longer than specified by the value of the Mode Parameter "Write Delay Time" shall be automatically written to media.
- When a nonwrite type media access command is received (for example, SPACE, READ, UNLOAD, . . .)
- When a SCSI Bus Reset or a Bus Device Reset message is received.

8.2.7 Other SCSI Functionality

1. Linked commands are supported.
2. Untagged queuing is supported.
3. The DLT2000 does not use the Wide-SCSI data path.

8.2.8 Bus Phases

The DLT2000 conforms to the bus state transition table shown in the SCSI-2 standard, "Phase Sequences." The information in the following sections also applies.

8.2.9 ATTENTION Signal Response

The DLT2000 will respond to an ATN condition at least at every phase transition, as long as the initiator sets the ATN bit before the target deasserts the REQ for the last byte of the previous phase. Generally ATN will be recognized immediately by the DLT2000, and it will change the bus phase to Message Out.

8.2.10 STATUS phase

The DLT2000 will enter the status phase just once per command, unless a retry is requested by the initiator. The only exception is during error cases when the device goes immediately to bus free, as defined in the SCSI-2 standard.

Status bytes the tape drive returns are as follows:

- GOOD (00): This status indicates the drive successfully completed the command.
- CHECK CONDITION (02): A contingent allegiance condition occurred. The REQUEST SENSE command should be sent following this status to determine the nature of the event.
- BUSY (08): The target is busy. This status is returned whenever the device is unable to accept a command from an otherwise acceptable initiator. The initiator should reissue the command at a later time.
- INTERMEDIATE GOOD (10h): This status is returned instead of GOOD status for commands issued with the LINK bit set. Following the return of this status, the drive will proceed to the COMMAND phase for the transfer of the next linked command.
- RESERVATION CONFLICT (18h): This status is returned by the drive whenever a SCSI device attempts to access the drive when it has been reserved for another initiator with a RESERVE UNIT command.
- COMMAND TERMINATED (22h): This is the status returned for a command that was terminated by a TERMINATE I/O PROCESS message. This status also indicates that a contingent allegiance condition has occurred.

Note

In contrast to the BUSY status condition, the DRIVE NOT READY Sense Key is returned as part of the Sense data following a REQUEST SENSE command and indicates that a media access command has been issued and the media is not ready to be accessed (for example, the media is not installed, the media has been unloaded, the drive is currently initializing the media to prepare it for access, and so forth.)

In the not ready state, the initiator cannot perform any operation which would cause tape motion (for example, write, read, verify, space, and so forth). These commands will return a CHECK CONDITION status with a DRIVE NOT READY sense key. The initiator may, however, execute commands that do not require access to the media and a GOOD status may be returned. These commands are as follows:

These commands are as follows:

- INQUIRY
- LOAD UNLOAD
- LOG SENSE/SELECT
- MODE SELECT
- MODE SENSE
- PREVENT/ALLOW MEDIUM REMOVAL
- READ BLOCK LIMITS
- READ BUFFER
- READ ELEMENT STATUS
- RECEIVE DIAGNOSTIC RESULTS
- REQUEST SENSE
- RESERVE/RELEASE UNIT
- SEND DIAGNOSTIC (non-media access diagnostics)
- WRITE BUFFER

The TEST UNIT READY command is used to determine whether the tape drive would accept a media access command without returning CHECK CONDITION status.

8.2.11 BUS FREE

There are several situations when the device might or will go to BUS FREE unexpectedly, as defined in the SCSI-2 standard (see sections 6.1.1 and 6.3):

- An internal hardware or firmware fault that makes it unsafe for the device to continue operation without a full reset (similar to a power-up reset).
- ATN asserted or bus parity error detected during non-tape data transfers.

8.2.12 BUS PARITY ERRORS

The occurrence of bus parity errors (i.e. single bit errors) are very serious because they imply the possibility of undetected double-bit errors on the bus, which most likely would result in undetected data corruption. On properly configured SCSI buses, parity errors should be extremely rare. If any are detected, they should be quickly addressed by improving the configuration of the SCSI bus. A well configured SCSI system in a normal environment should be virtually free of bus parity errors

Bus parity errors cause the drive to either retry the operation, go to STATUS phase, or go to bus free and prepare Sense Data (see section 6.1.1 in the SCSI-2 specification). Retrying of parity errors during Data Out Phase when writing is normally not done, but can be enabled by changing the EnaParErrRetry parameter in the VU EEROM Mode Page. This feature is not enabled by default because of negative impacts on device performance (the data stream on writes cannot be pipelined as well).

8.3 SCSI Message System

The message system allows communication between an initiator and a target for the purpose of physical path management.

To support certain SCSI-1 initiators, an Identify message is not required by the DLT2000. If a message is sent by the initiator after the SELECTION phase, it should be an IDENTIFY, ABORT, or BUS DEVICE RESET message. If the DLT2000 receives any other message in this case, it will go directly to BUS FREE phase.

The following messages are supported:

Table 8-1 *Supported SCSI Messages*

Code	In/Out	Description	Section
06	Out	ABORT	ABORT (06h)
0D	Out	ABORT TAG	ABORT TAG (0Dh)
0C	Out	BUS DEVICE RESET	BUS DEVICE RESET (0Ch)
0E	Out	CLEAR QUEUE	CLEAR QUEUE (0Eh)
00	In	COMMAND COMPLETE	COMMAND COMPLETE (00h)
04	In	DISCONNECT	DISCONNECT (04h)
01	Both	EXTENDED MESSAGE (SDTR only and wide Data Transfer Request-See note)	ExtENDED MESSAGE (01h)
08-FF	Both	IDENTIFY	IDENTIFY (80h-FFh)
05	Out	INITIATOR DETECTED ERROR	INITIATOR DETECTED ERROR (05h)
0A	In	LINKED COMMAND COMPLETE	LINKED COMMAND COMPLETE (0Ah)
0B	In	LINKED COMMAND COMPLETE w/flag	LINKED COMMAND COMPLETE, with flag (0Bh)
09	Out	MESSAGE PARITY ERROR	MESSAGE PARITY ERROR (09h)
07	Both	MESSAGE REJECT	MESSAGE REJECT (07h)
08	Out	NO-OP	NO-OP (NO OPERATION)(08h)
03	In	RESTORE POINTERS	RESTORE POINTERS (03h)
02	In	SAVE DATA POINTER	SAVE DATA POINTER (02h)

ABORT (06h)

This message is sent from the initiator to the target to clear, on the selected unit, the current I/O process. Buffered (cached) write operations will be completed if possible. The target goes directly to the BUS FREE phase after successful receipt of this message. Current settings of Mode Select parameters and reservations are not affected. Commands, data, and status for other initiators is not affected.

This message can be sent to a logical unit that is not currently performing an operation for the initiator. If no unit has been selected, the target goes to BUS FREE and no commands, data, or status on the target is affected.

ABORT TAG (0Dh)

This message is sent from the initiator to the target to clear, on the selected unit, the current I/O operation only. The target goes directly to the BUS FREE phase after successful receipt of this message. Current settings of Mode Select parameters and reservations are not affected. The data on the cache will be flushed to the tape.

BUS DEVICE RESET (0Ch)

This message from an initiator clears all commands, data, and status in the tape controller. When it recognizes this message, the drive flushes the cache to tape and proceeds to the BUS FREE state. The drive then executes a hard reset which leaves it as if a Bus Reset had occurred. All data in the write buffer will be flushed to the media.

CLEAR QUEUE (0Eh)

This message clears all I/O processes for all initiators. A Unit Attention condition will be generated for all other initiators that had outstanding I/O processes, with Additional Sense Code (ASC) of Command Cleared by Another Initiator. The target goes directly to the BUS FREE phase after successful receipt of this message. Current settings of Mode Select parameters and reservations are not affected. The data on the cache will be flushed to the tape.

COMMAND COMPLETE (00h)

This message is sent from a target to an initiator to indicate that the execution of a command (or a series of linked commands) has completed and valid status has been sent to the initiator. After it has sent the message successfully, the target goes to the BUS FREE phase by releasing BSY. If received by the tape unit, it is handled as an illegal message; the drive returns MESSAGE REJECT and enters the STATUS phase reporting CHECK CONDITION with the sense key set to COMMAND ABORTED.

DISCONNECT (04h)

A target sends DISCONNECT to tell an initiator that the present physical path is going to be broken (the target intends to disconnect by releasing BSY). Later, reselection is required in order to complete the current operation. This message does not cause the initiator to save the Data pointer.

When received from an initiator, the tape drive enters the message in phase and return MESSAGE REJECT.

EXTENDED MESSAGE (01h)

This is sent as the first byte of a multiple-byte message (> 2 bytes) by either initiator or target. ExtENDED MESSAGE has the following format:

Byte 0	Extended Message Identifier − 01h
Byte 1	Extended Message Length
Byte 2	Extended Message Code
Byte 3	Extended Message additional parameters

Figure 8-1 *Extended Message Format*

The Extended Message Length specifies the length of the Extended Message plus the number of additional parameter bytes that are to follow. The length does not include bytes 0 and 1. A value of zero for the Extended Message Length indicates 256 bytes to follow.

Possible Extended Message codes are:

00h - MODIFY DATA POINTER (not supported)

01h - SYNCHRONOUS DATA TRANSFER REQUEST

02h - Reserved

03h - WIDE DATA TRANSFER REQUEST (supported on some models)

04h-7Fh - Reserved

80-FFh - Vendor Unique

If the tape drive receives an extended message which it does not support, it switches to message in phase and returns MESSAGE REJECT after all the bytes of the message have been transferred.

IDENTIFY (80h-FFh)

These messages are sent either by the initiator or by the target to establish (or reestablish) the physical connection path between an initiator and target for a particular logical unit. The message byte consists of the following bits:

Bit 7: Always set to one.

Bit 6: Set by initiator if target is allowed to disconnect/reconnect.

Bit 5: Must be set to zero ("Target Routines" not supported).

Bit 4: Reserved. Must be set to zero.

Bit 3: Reserved. Must be set to zero.

Bits 2-0: Logical Unit Number (LUN).

When the Identify message is sent from a target to an initiator during reconnection, a RESTORE POINTERS message is implied.

INITIATOR DETECTED ERROR (05h)

This message is sent from an initiator to inform a target that an error (for example, a bus parity error) has occurred that does not prevent the target from trying the operation again. When received, the DLT2000 attempts to retransfer the last command, data, or status bytes by using the RESTORE POINTERS message mechanism.

LINKED COMMAND COMPLETE (0Ah)

This message is sent from a target to an initiator to indicate that the execution of a linked command (with the Flag bit zero) is complete and that status has been sent. The initiator then sets the pointers to the initial state for the next command.

When received as a target, it is handled as an illegal message; the drive enters the MESSAGE IN phase and returns MESSAGE REJECT.

LINKED COMMAND COMPLETE, with flag (0Bh)

This message is sent from a target to an initiator to indicate that the execution of a linked command (with the Flag bit set to one) is complete and that status has been sent.

MESSAGE PARITY ERROR (09h)

This message is sent from the initiator to the target to indicate that one or more bytes in the last message it received had a parity error.

To indicate that it intends to send the message, the initiator sets the ATN signal before it releases ACK for the REQ/ACK handshake of the message that has the parity error. This provides an interlock so that the target can determine which message has the parity error. If the target receives this message under any other conditions, it proceeds directly to the BUS FREE state by releasing the BSY signal, signifying a catastrophic error.

The target's response to this message shall be to switch to the MESSAGE IN phase and re-send from the beginning all the bytes of the message which generated the original MESSAGE PARITY ERROR message.

MESSAGE REJECT (07h)

This message is sent from the initiator or target to indicate that the last message received was inappropriate or has not been implemented.

To indicate its intentions of sending this message, the initiator asserts the ATN signal before it releases ACK for the REQ/ACK handshake of the message that is to be rejected.

MESSAGE REJECT is issued in response to any messages the drive considers to be illegal or not supported. When sending to the initiator, the tape device will do so before requesting any additional message bytes.

NO-OP (NO OPERATION) (08h)

If a target requests a message, the initiator sends NO-OP if it does not currently have any other valid message to send. The message is accepted when the drive is acting as a target, and may be sent when it is an initiator. If NO-OP is received during a selection, the drive proceeds to the COMMAND phase (provided ATN does not continue being asserted). The NO-OP message is ignored by the tape drive.

RESTORE POINTERS (03h)

This message is sent from a target to direct the initiator to restore the most recently saved pointers (for the currently attached logical unit). Pointers to the command, data, and status locations for the logical unit are restored to the active pointers. Command and Status pointers are restored to the beginning of the present Command and Status areas. The Data pointer is restored to the value at the beginning of the data area in the absence of a SAVE DATA POINTER message, or to the value at the last SAVE DATA POINTER message that occurred for that logical unit.

When the RESTORE POINTERS message is received as a target, the target switches to the message in phase and returns MESSAGE REJECT.

SAVE DATA POINTER (02h)

This message, sent from a target to the initiator, saves a copy of the present active Data pointer for the logical unit currently attached.

As a target, the tape drive sends this message before a disconnect during a data transfer. It does not send a SAVE DATA POINTER message if it intends to move directly to STATUS phase. When received as a target, it switches to message in phase and returns MESSAGE REJECT.

Synchronous Data Transfer Request (SDTR)

This extended message allows the target and initiator to agree on the values of the parameters relevant to synchronous transfers. DLT2000 will *not* initiate the Synchronous Data Transfer Request message, but relies on the Initiator to do so. The SDTR message has the following format:

Byte 0	Extended Message Identifier − 01h
Byte 1	Length = 3
Byte 2	Message Code = 1 (SDTR msg)
Byte 3	Transfer Period (min=50. = 32h)
Byte 4	Transfer Req/Ack Offset (max=15)

Figure 8-2 *SDTR Extended Message Format*

NOTE

The tape drive supports initiating synchronous transfer negotiations with the host, but this feature is disabled by default. To enable it, set the Mode Select VU ERROM parameter EnaInitSyncNeg.

8.4 Tape Drive SCSI Commands

8.4.1 Control Byte - Flag and Link Bits

The control byte of the Command Descriptor Block contains the Flag and Link bits. Use of these bits is entirely initiator dependent. Setting the Link bit provides an automatic link to the next command, bypassing the usual ARBITRATION, SELECTION, and MESSAGE OUT phases which would normally occur between commands.

All other bits in the Control Byte are considered to be reserved.

8.4.2 Summary of Supported Sequential-Access Device Commands

The following table shows what SCSI commands are supported by the DLT2000 tape drive.

Table 8-2 *DLT2000 Supported SCSI Commands*

Opcode	Command	Section
19	ERASE	8.4.3
12	INQUIRY	8.4.4
1B	LOAD-UNLOAD	8.4.5
2B	LOCATE	8.4.6
4C	LOG SELECT	8.4.7
4D	LOG SENSE	8.4.8
15	MODE SELECT	8.4.9
1A /5A	MODE SENSE	8.4.10
1E	PREVENT/ALLOW MEDIUM REMOVAL	8.4.11
08	READ	8.4.12
05	READ BLOCK LIMITS	8.4.13
3C	READ BUFFER	8.4.14
34	READ POSITION	8.4.15
1C	RECEIVE DIAG RESULTS	8.4.16
17	RELEASE UNIT	8.4.17
03	REQUEST SENSE	8.4.18
16	RESERVE UNIT	8.4.19
01	REWIND	8.4.20
1D	SEND DIAGNOSTIC	8.4.21
11	SPACE	8.4.22
00	TEST UNIT READY	8.4.23
13	VERIFY	8.4.24
0A	WRITE	8.4.25
3B	WRITE BUFFER	8.4.26
10	WRITE FILEMARK	8.4.27

8.4.3 ERASE (19h)

Byte	Bit 7	6	5	4	3	2	1	0
0	Operation Code (19h)							
1	Logical Unit Number			Reserved			Immed	Long
2	Reserved							
3	Reserved							
4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 8-3 *ERASE CDB*

ERASE causes data on the tape to be erased. Any write data currently held in buffer memory and not written to tape yet is flushed to tape before the ERASE is executed.

Immed

If the Immediate bit is set to zero, the target will not return status until the selected operation has completed. If the bit is set to one, status will be returned as soon as the operation has been initiated.

Long

The Long bit controls the distance to be erased. If the bit is set, filler and EOD blocks will be written if needed, and then the entire rest of the tape will be erased.

Note

This command is an NOP on the DLT2000 unless the Long bit is set. Issuing the ERASE command away from BOT is an ILLEGAL REQUEST.

8.4.4 INQUIRY (12h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (12h)							
1	Logical Unit Number			Reserved				EVPD
2	Page Code							
3	Reserved							
4	Allocation Length							
5	Unused		Reserved				Flag	Link

Figure 8-4 *INQUIRY CDB*

INQUIRY tells the drive to send information regarding the device's parameters to the initiator.

The INQUIRY command executes normally even if the specified LUN is not attached. INQUIRY returns a Check Condition status only when the target cannot return the requested Inquiry data. If INQUIRY is received from an initiator with a pending UNIT ATTENTION condition (before the drive reports CHECK CONDITION status), the target will perform the INQUIRY and will not clear the UNIT ATTENTION condition.

EVPD

The DLT2000 implements the Vital Product Data pages option on LUNs 0 and the optional medium loader LUN.

Page Code

There are three Vital Product Data pages implemented:

00h - Supported Vital Product Data pages

80h - Unit Serial Number page

C0h - Code Build Information page

If the page code field contains a different value, the drive generates a CHECK CONDITION with ILLEGAL REQUEST sense key.

Allocation Length

This specifies the maximum number of bytes that the initiator has allocated for returned Inquiry data. An Allocation Length of zero indicates that no Inquiry data is transferred. This condition is not considered an error. The drive will terminate the DATA IN phase

when Allocation Length bytes have been transferred, or when all available Inquiry data has been transferred to the initiator, whichever is less.

8.4.4.1 Drive Inquiry Response

The DLT2000 passes back the following information in response to an INQUIRY command on the drive LUN:

<table>
<tr><th>Byte</th><th colspan="8">Bit</th></tr>
<tr><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>0</td><td colspan="3">Peripheral Qualifier</td><td colspan="5">Peripheral Device Type</td></tr>
<tr><td>1</td><td>RMB</td><td colspan="7">Device Type Modifier</td></tr>
<tr><td>2</td><td colspan="2">ISO Version</td><td colspan="2">ECMA Version</td><td colspan="4">ANSI-Approved Version</td></tr>
<tr><td>3</td><td>Anec</td><td>TrmIOP</td><td colspan="2">Reserved</td><td colspan="4">Response Data Format</td></tr>
<tr><td>4</td><td colspan="8">Additional Length (33h)</td></tr>
<tr><td>5</td><td colspan="8">Reserved</td></tr>
<tr><td>6</td><td colspan="8">Reserved</td></tr>
<tr><td>7</td><td>RelAdr</td><td>WBus32</td><td>WBus16</td><td>Sync</td><td>Linked</td><td>RSVD</td><td>CmdQue</td><td>SftRe</td></tr>
<tr><td>8-15</td><td colspan="8">Vendor ID = “Quantum “</td></tr>
<tr><td>16-31</td><td colspan="8">Product ID = “DLT2000 “</td></tr>
<tr><td>32-35</td><td colspan="8">Product Revision Level = “hhss”</td></tr>
<tr><td>36-55</td><td colspan="8">Vendor Unique bytes</td></tr>
</table>

Figure 8-5 *INQUIRY Response Data*

Peripheral Qualifier

The tape drive returns one of the following values in this field:

- 000b - The indicated Peripheral Device Type is connected to the logical unit.
- 001b - The indicated Peripheral Device Type is not connected to the logical unit; however, the tape drive is capable of supporting the indicated Peripheral Device Type at the specified logical unit.
- 011b - The target is not capable of supporting a physical device on this logical unit. For this case, the Peripheral Device Type will be set to 1Fh.

Peripheral Device Type

On the tape drive LUN, this field is set to 01h, indicating a sequential access device. On the Medium Changer LUN, this field is set to 08h. All other LUNs will return 1FH.

Other Inquiry Data Fields

The rest of the fields in the Inquiry Response are used as follows:

- Byte 1

  RMB - The Removable Medium bit is one.

  Device-Type Modifier - Set to 0.
- Byte 2:

  IOS Version - Set to 0

  ECMA Version - Set to 0

  ANSI Approved Version - Set to 02h, indicating compliance with SCSI-2
- Byte 3:

  ANEC - Set to 0 (Asynchronous Event Notification not supported)

  TrmIOP - Set to 1 (TERMINATE I/O PROCESS message supported)

  Response Data Format - Set to 2 (Inquiry Data in SCSI-2 format)
- Byte 4: Additional Length - The tape drive sets this field to indicate the number of additional bytes of INQUIRY Response Data available
- Byte 6: All bits set to zero, except:

  MChngr - Set to 1 if an integrated Media Loader is present and EEROM parameter EnbIngMedChgr is set to 1. This SCSI-3 bit indicates that the Read Element Status and Move Medium commands can be issued to the drive LUN (0). By default, this bit is off on the DLT4000 products.
- Byte 7: All bits set to zero, except:

  Sync - Set to 1 (synchronous data transfer supported)

  Linked - Set to 1 (linked commands supported)
- Vendor Identification - See figure 8-6
- Product Identification - See figure 8-6

- Product Revision Level - This field contains four bytes of ASCII data, which define the product's software Revision Levels. The first tow bytes are the version number of servo code. in the DLT2000 products, this firmware is located in a PROM and is not field updateable. The second two bytes are the version number of the SCSI/read/write code. When a firmware update is performed on the DLT2000 , this part of the Revision Level field will change appropriately.

Note

If a 5 cartridge media loader is attached to the tape drive, the Product ID will indicate "DLT2500" instead of "DLT2000".

If a 7 cartridge media loader is attached to the tape drive, the Product ID will indicate "DLT2700" instead of "DLT2000".

Product Revision Level

This field contains four bytes of ASCII data, which define the product's software Revision Levels. The first two bytes are the version number of servo code; the second two bytes are the version number of the SCSI/read/write code. When a firmware update is performed on the DLT2000 , the product Revision Level field will change appropriately.

Vendor Specific

Vendor Specific - See next section.

8.4.4.2 Vendor Unique Inquiry Data

The following information can be used to precisely identify the revision of subsystem components.

Bit

Byte		
	36	Released SCSI (controller) Firmware
	37	Firmware Major Version #
	38	Firmware Minor Version #
	39	EEPROM Format Major Version #
	40	EEPROM Format Minor Version #
	41	Firmware Personality
	42	Firmware Sub-personality
	43	Tape Directory Format Version #
	44	Controller Hardware Version #
	45	Drive EEPROM Version #
	46	Drive Hardware Version #
	47	Media Loader Firmware Version #
	48	Media Loader Hardware Version #
	49	Media Loader Mechanical Version #
	50	Media Loader Present flag
	51-55	Module Revision

Figure 8-6 *INQUIRY Vendor Unique Bytes Definition*

Vendor Specific Inquiry Bytes

To more precisely identify the product and the installed firmware, additional information is available.

Released Flag

This flag differentiates between released and test versions of firmware. One indicates released code (Vxxx) or field test code (Txxx). Released code has no Minor FW Version number (byte 38 is 0). Field Test and engineering versions of code have non-zero Minor FW Version numbers for tracking purposes.

Various Version Numbers

In binary, not ASCII (see figure).

Firmware Personality

Numeric indicator of firmware personality. Set to 4.

Sub-Personality

Further differentiates product versions, currently set to a 1.

Loader Present

Nonzero if a media loader is present.

Library Present

Nonzero if a library is attached.

Module Revision

A four byte ASCII string represents the revision of the ECM module.

8.4.4.3 Vital Product Data Pages

The following figures show the information in the supported Vital Product Data Pages.

Byte	Bit 7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (00h)							
2	Reserved							
3	Page Length (3 more bytes)							
4	00h - (this page)							
5	80h - Unit Serial Number page							
6	C0h - Firmware Build Info page (VU)							

Figure 8-7 *Supported Vital Product Data Pages*

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (80h)							
2	Reserved							
3	Page Length (0Ah)							
4 - 13	Serial Number							

Figure 8-8 *Unit Serial Number page*

Serial Number

The serial number is the serial number of the printed circuit card mounted on the bottom of the DLT2000. It can be found on the bar code label. The serial number is returned in ASCII.

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (C0h)							
2	Reserved							
3	Page Length (20h)							
4 - 5	Servo Firmware Checksum							
6 - 7	Servo EEPROM Checsum							
8 - 11	Read/Write Firmware Checksum							
12 -35	Read/Write Firmware build Data							

Figure 8-9 *Firmware Build Information page - VU*

The checksums are binary, and are for positive Firmware and EEPROM identification.

Firmware Build Date is an ASCII string in the DD-Mmm-YYYY HH:MM::SS format.

8.4.4.4 Media Loader Inquiry Response

The DLT2000 controller generates INQUIRY Data on the Medium Changer LUN that is very similar to that of the tape drive LUN. The key differences are:

- Peripheral Device Type is set to "8" for SCSI-2 Medium Changer
- Product ID bytes are set to DLT2500 or DLT2700 for 5 or 7 cartridge loader, respectively.

8.4.5 LOAD-UNLOAD (1Bh)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code(1Bh)							
1	Logical Unit Number			Reserved				Immed
2	Reserved							
3	Reserved							
4	Reserved					EOT	Re−Ten	Load
5	Unused		Reserved				Flag	Link

Figure 8-10 *LOAD-UNLOAD CDB*

LOAD-UNLOAD tells the target to load or unload the media in the tape cartridge. If no cartridge is in the drive, both LOAD and UNLOAD will return a CHECK CONDITION status with a NOT READY sense key set. If the drive has received an UNLOAD command with the Immed bit set and then receives another command which would involve tape motion or TEST UNIT READY, the drive will return a CHECK CONDITION status with a NOT READY sense key set.

Operation of the Unload version of this command will be different if a media loader is present.

Two modes of operation are possible when a media loader is attached. If none of the media loader specific commands has been issued, then the device will operate in the sequential mode of operation. Once a media loader specific command has been issued, the sequential mode of operation is disabled and the UNLOAD command becomes a no-op.

If the device is still in the default sequential mode of operation and an UNLOAD command is received by the subsystem, the current cartridge will be unloaded and automatically moved to the magazine slot from which it originated. Then, the cartridge from the next slot in the magazine, if not empty, is automatically moved from the magazine into the drive, loaded, and made ready. If the next magazine slot is empty, no CHECK CONDITION status is created.

When the cartridge is unloaded into magazine slot 6 (the last one), the subsystem does not cycle back to slot 0. This prevents accidental overwriting of data when using the subsystem in sequential auto-loading mode. The next cartridge must be selected and loaded manually, or with a SCSI Move Medium command.

EEROM parameters ENALDRAUTOLD and DISLDRAUTOLDMC can be modified to enable/disable the sequential loading feature (Table 8-3).

A media loader does not affect the device's processing of the LOAD flavor of the LOAD-UNLOAD command.

The command specific bits are used as follows:

- Immed - If this bit is set, status is returned as soon as the operation is started. Otherwise, the status is returned after the operation has completed.
- Re-Ten - Re-tension operations are not needed on the DLT2000, so this bit is ignored (that is, good status, if the bit is set).
- Load - When a cartridge is inserted, the media is automatically loaded and positioned by the drive at BOM. Logically, the drive will be positioned at the beginning of Partition 0.

  If the Load bit is set, and the media is already loaded, no action is taken. If the media was unloaded but the cartridge was not removed, a Load will cause it to be loaded to BOP again and made ready.

  If the Load bit is zero and media is loaded, the drive writes any buffered data and filemarks to the tape and rewinds the tape to BOM and unloads the media into the DLT2000 cartridge. The green Operate Handle light turns on and the cartridge can be removed from the drive. If the media is already unloaded, no action is taken.
- EOT - This bit is ignored by the DLT2000, unless both the EOT and Load bits are both set, then the drive returns CHECK CONDITION, ILLEGAL REQUEST.

8.4.6 LOCATE (2Bh)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (2Bh)							
1	Logical Unit Number			Reserved		BT	CP	Imm
2	Reserved							
3	(MSB)							
4	Block Address							
5								
6								(LSB)
7	Reserved							
8	Partition							
9	Unused		Reserved				Flag	Link

Figure 8-11 *LOCATE CDB*

The LOCATE command is used to do high-speed positioning to the specified block address. Average positioning time is about 45 seconds; maximum time is under 90 seconds.

The READ POSITION command can be used to obtain the block address, when Writing, where particular blocks of data (for example, a data file) are about to be written. Then the LOCATE command can be used to position back to the same logical position for high performance restore operations of particular blocks of data.

- BT - The Block Type bit indicates how the Block Address field is interpreted. For the DLT2000 products, SCSI Logical Block addresses are always returned, that is, setting the BT bit does not affect the values returned. The first recorded object (block or filemark) is at address zero, and Block Addresses count both data blocks and filemarks.
- CP - Since multiple partitions are not supported this bit must be zero.
- Imm - If set, STATUS is returned when the command has been started.

Block Address

The Block Address field defines the SCSI Logical Block Address to which the media will be positioned. These addresses start at zero, and include data blocks and filemarks, so they could also be considered an object address.

8.4.7 LOG SELECT (4Ch)

<table>
<tr><th></th><th></th><th colspan="8">Bit</th></tr>
<tr><th></th><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td rowspan="10">Byte</td><td>0</td><td colspan="8">Operation Code (4Ch)</td></tr>
<tr><td>1</td><td colspan="3">Logical Unit Number (0)</td><td colspan="3">Reserved</td><td>PCR</td><td>SP</td></tr>
<tr><td>2</td><td colspan="2">PC</td><td colspan="6">Reserved</td></tr>
<tr><td>3</td><td colspan="8">Reserved</td></tr>
<tr><td>4</td><td colspan="8">Reserved</td></tr>
<tr><td>5</td><td colspan="8">Reserved</td></tr>
<tr><td>6</td><td colspan="8">Reserved</td></tr>
<tr><td>7</td><td colspan="8" rowspan="2">(MSB)
Parameter List Length
(LSB)</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td colspan="2">Unused</td><td colspan="4">Reserved</td><td>Flag</td><td>Link</td></tr>
</table>

Figure 8-12 *LOG SELECT CDB*

LOG SELECT allows the host to manage statistical information maintained by the device about its own hardware or the installed media. The description should be read in conjunction with the description of the LOG SENSE command which follows it, to provide the reader with information about log page format, parameters, and supported pages. The command specific bits are used as follows:

- PCR - If Parameter Code Reset bit is set to 1 and parameter list length is 0, all accumulated values of page code 2, 3, and 32 are set to zero and all threshold values are set to default. If PCR is set to 1 and the Parameter List Length Field is not zero, the command will be terminated with a CHECK CONDITION Status, with Sense Key of ILLEGAL REQUEST, and ASC of INVALID FIELD IN CDB.
- SP - The Save Page bit is not supported and must be set to zero. If the SP bit is set, the command will be terminated with CHECK CONDITION Status, with Sense Key of ILLEGAL REQUEST, and ASC of INVALID FIELD IN CDB.
- PC - The Page Control field defines the type of parameter values to be selected:

PC	Type of Parameter Values
00b	Threshold Values
01b	Cumulative Values
10b	Default Threshold Values
11b	Default Cumulative Values

Figure 8-13 *LOG Page Control Definitions*

All types of parameter values are changeable through Log Select.

When the PC field is set to 00b or 01b and the Parameter List Length is zero, the command is terminated with a CHECK CONDITION Status, with Sense Key of ILLEGAL REQUEST, and ASC of INVALID FIELD IN CDB. This is because modification of Current Threshold Values and Current Cumulative Values is not supported.

When the PC field is set to 10b and the Parameter List Length field is 0 then all Current Threshold Values will be reset to the Default Threshold Values. This is equivalent to no change as Threshold Values cannot be modified.

When the PC field is set to 11b and the Parameter List Length field is 0 then all Current Cumulative Values will be reset to the Default Cumulative Values. This is equivalent to clearing all log pages which can be cleared.

Parameter List Length

This field specifies the length in bytes of the LOG SELECT parameter list to be transferred from the initiator to the target during the DATA OUT phase. A parameter list length of zero indicates that no data is to be transferred. This condition is not considered an error (see the description of Parameter Code Reset and Page Control fields in this section).

Error Detection Summary in LOG SELECT CDB

The following conditions constitute errors that will be detected by the drive in relation to the CDB. The request sense data is set to ILLEGAL REQUEST, INVALID FIELD IN CDB.

- If PCR bit is set to 1 and parameter list length is not zero
- If SP bit is set 1

•A parameter list length that would cause a parameter within a valid page to be truncated or otherwise incompletely initialized.

8.4.7.1 Operation of LOG SELECT

The purpose of the LOG SELECT command is to allow the initiator to modify and initialize parameters within the logs supported by the device.

There are two ways to initialize the log parameters. First, set the PCR bit in the LOG SELECT CDB; this clears all parameters. Secondly, individual pages can be cleared by specifying the log page and the parameter value as the log parameters. The following pages can be cleared in this manner.

Page Code	Page Description
02h	Write Error Counter Page
03h	Read Error Counter Page
32h	Compression ratio page

Figure 8-14 *Clearable Log Pages*

If multiple pages are sent during this DATA OUT phase, they must be sent in ascending order according to page code. Otherwise the command will terminate with a CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and an additional sense code of INVALID FIELD IN PARAMETER LIST. The same status will be returned if an unsupported Page Code appears in any header, or if the specified page cannot be cleared.

LOG SELECT PAGE FORMAT

Each Log page will begin with a 4-byte header followed by N log parameter blocks (one block for each parameter code). Each block, except for parameter code 05h, will be 8 bytes. The parameter block for code 05h will be 12 bytes.

Log Page Header

Byte \ Bit	7	6	5	4	3	2	1	0
0	Reserved		Page Code					
1	Reserved							
2	(MSB)			Page Length				
3								(LSB)

Log Parameters

Byte	7	6	5	4	3	2	1	0
0	(MSB)			Parameter Length				
1								(LSB)
2	DU	DS	TSD	ETC	TMC		Rsvd	LP
3	Parameter Length							
4	(MSB)							
5				Parameter Value				
6								
7								(LSB)

Figure 8-15 *Read/Write Error Log Select Page Format*

Page Code

The Page Code specifies what Log Page this LOG SELECT command is for.

Page Length

The page length specifies the total number of bytes contained in this log page, not including the four bytes of the header.

Parameter Code

Parameter codes supported for the read/write error counter pages are described in figure 8-16.

Parameter Code	Description
00h	Errors corrected with substantial delays
01h	Errors corrected with possible delays
02h	Total rewrites or rereads
03h	Total errors corrected
04h	Total times correction algorithm processed
05h	Total bytes processed
06h	Total uncorrected errors
8000h	Vendor Unique

Figure 8-16 *Parameter Codes Supported*

Parameter codes 00h, 01h, and 04h will always return a value of zero.

Note

Parameter value for code 05h will be 8 bytes; the parameter length will be set to 8.

Byte 2 of Log parameter block in Figure 8-15 is referred to as the parameter control byte.

- DU–Disable Update: DU bit is not defined for LOG SELECT and the target shall ignore any value.
- DS and TSD–Saving parameters is not supported; they both should be set to 1. If the DS and/or TSD are set to zero, the command is terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST with the additional sense code set to INVALID FIELD IN PARAMETER LIST.
- ETC–Enable Threshold Comparison: When set to 1, the drive will perform a comparison with threshold values once the cumulative value is updated. Comparison criteria is defined in TMC. If the comparison is met and the RLEC bit of MODE SELECT/SENSE Control Page is set to 1, then a UNIT ATTENTION *is* generated for all initiators. The additional sense code is set to LOG EXCEPTION and the additional sense code qualifier is set to THRESHOLD CONDITION MET. If the RLEC bit is zero and the comparison is met, then UNIT ATTENTION *is not* generated.
- TMC–Threshold Met Criteria: See Figure 8-23 for the list of criteria. Once the specified criteria in this field is met and the ETC bit is 1 and the RLEC bit in MODE SENSE/SELECT Control Page is set to 1, then UNIT ATTENTION is generated for all initiators.

- LP–List Parameter: This bit should always be set to 0 to indicate parameter codes are treated as data counters.

Error Detection Summary in Log Select Pages

The host should issue a LOG SENSE command to initialize host software which allows:

- Correct determination of the pages the drive uses
- Determination of the parameter codes and length of each parameter

The following conditions constitute errors in the parameter block that will cause the drive to return CHECK CONDITION with the sense data set to ILLEGAL REQUEST and additional sense code INVALID FIELD IN PARAMETER LIST:

- If a page header is received with unsupported page codes
- Incorrect log page length is specified in the page header
- An illegal parameter code within a valid page code
- Parameter codes for a supported page are not sent in ascending order
- LP bit is set to 1 in the parameter control byte
- DS bit is set to zero in the parameter control byte
- TSD bit is set to zero in the parameter control byte

8.4.8 LOG SENSE (4Dh)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (4Dh)							
1	Logical Unit Number (0)			Reserved			PPC	SP(0)
2	PC		Page Code					
3	Reserved							
4	Reserved							
5	(MSB) Parameter Pointer							
6								(LSB)
7	(MSB) Allocation Length							
8								(LSB)
9	Unused		Reserved				Flag	Link

Figure 8-17 *LOG SENSED CDB*

LOG SENSE allows the host to retrieve statistical information maintained by the device about its own hardware or the installed media. It is a complementary command to LOG SELECT.

PPC

The Parameter Pointer Control bit must be zero. A Parameter Pointer Control bit of zero indicates that the parameter data requested from the device will start with the parameter code specified in the Parameter Pointer field and return the number of bytes specified in the Allocation Length field in ascending order of parameter codes from the specified log page. A PPC bit of zero and a Parameter Point field of zero causes all available parameter data for that page code to be returned to the initiator.

Note

> The current implementation of the Read/Write Compression Page does not support a parameter pointer other than zero.

If PPC bit is set or the Parameter Pointer is larger than the highest numbered parameter on the page, then the target will terminate the command with CHECK CONDITION

status. The sense key is set to ILLEGAL REQUEST and the additional sense code is set to INVALID FIELD IN CDB.

If the target does not support a parameter code within this page then it will not return any data associated with this parameter.

SP

Saving log parameters is not supported and shall be always zero.

If the SP bit is set, the command is terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST, and an additional sense code of INVALID FIELD IN CDB.

PC

The Page Control field defines the type of parameter values to be returned:

PC	Type of Parameter Values
00b	Threshold Values
01b	Cumulative Values
10b	Default Threshold Values
11b	Default Cumulative Values

Figure 8-18 *LOG Page Control Definitions*

The Default Threshold Values are the maximum values that each parameter can attain.

The Current Cumulative Values are the values computed since the last reset of the device (either by power-cycling, BUS DEVICE RESET, or SCSI RESET).

The Default Cumulative Values are the values to which each parameter gets initialized on a reset condition as described previously. Default values are zero.

By default Current threshold values = Default threshold values.

Note

All types of Parameter values are changeable through LOG SELECT.

Page Code

The Page Code field identifies which log page is being requested by the initiator. If the page is not supported then the command terminates with a CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and an additional sense code of INVALID FIELD IN CDB. Supported pages are as follows:

Page Code	Page Description
00h	List of Supported Pages Page
02h	Write Error Counter Page
03h	Read Error Counter Page
07h	Last n Errors Events Page
32h	Compression ratio page

Figure 8-19 *LOG SENSE Pages Supported*

Parameter Pointer

The Parameter Pointer field allows the host to specify at which parameter within a log page the requested data should begin. For example, if a page supports parameters 0 through 5, and the Parameter Pointer field contains 3, then only parameters 3, 4, and 5 are returned to the initiator. Similarly, if a page supports parameters 1, 3, and 6, and the Parameter Pointer field contains 2, then only parameters 3 and 6 are returned to the initiator.

If Parameter Pointer is larger than the highest numbered parameter on the page, then the target will terminate the command with CHECK CONDITION status. The sense key is set to ILLEGAL REQUEST and the additional sense code is set to INVALID FIELD IN CDB.

Note

Parameters within a page are always returned in ascending order according to parameter code.

Allocation Length

The Allocation Length field is used to inform the target how much space the initiator has allocated for data. There must be sufficient space allocated for all the requested data, otherwise the command will terminate with a CHECK CONDITION Status with Sense Key of ILLEGAL REQUEST, and ASC of INVALID FIELD IN CDB.

Error Detection Summary in LOG SENSE CDB

The following conditions constitute errors that will be detected by the drive in relation to the CDB. The request sense data is set to ILLEGAL REQUEST, INVALID FIELD IN CDB.

- If a page is not supported
- If the parameter pointer is larger than the highest numbered parameter on the page
- If SP bit is set to 1

8.4.8.1 Supported Pages Log Page (Page 0)

When page 0 is requested, the 4-byte page header is returned followed by the pages supported in ascending order, one byte for each.

Byte \ Bit	7	6	5	4	3	2	1	0
0	Reserved		Page Code (00h)					
1	Reserved							
2	(MSB)	Page LENGTH (05H)						
3								(LSB)
4	00h							
5	02h							
6	03h							
7	07h							
8	32h							

Figure 8-20 *Supported Pages Page Format*

8.4.8.2 Read/Write Error Log Page (Page 2 and 3)

Each Log page will begin with a 4-byte header followed by n number of log parameter blocks, each block of 8 bytes except for parameter code 5h.

The log parameter block for the Parameter total bytes processed (5h) will be 12 bytes, since the parameter value is 8 bytes long.

Log Page Header

Byte \ Bit	7	6	5	4	3	2	1	0
0	Reserved		Page Code					
1	Reserved							
2	(MSB)		Page Length					
3								(LSB)

Log Parameters

Byte								
0	(MSB)		Parameter Length					
1								(LSB)
2	DU	DS	TSD	ETC	TMC		Rsvd	LP
3	Parameter Length							
4	(MSB)							
—			Parameter Value					
—								
11								(LSB)

Figure 8-21 *Read/Write Error Log SENSE Page Format*

Page Code

The Page Code echoes the page code that was specific in the LOG SENSE CDB.

Page Length

The Page Length specifies the total number of bytes contained in this log page, not including the four bytes of the heads.

For example, if PPC bit is zero and parameter pointer is zero then target will return 4 bytes of page header with page length of 44h followed by 8 bytes of parameter value data for each parameter code except for parameter code 5h. For 5h, it will return 12 bytes.

So, for Parameter code 0h, 1h, 2h, 3h, 4h, 6h, and 8000h, each page will be 8 bytes. For parameter code 5h, page will be 12 bytes.

Parameter Code

The following parameter codes are supported for the read/write error counter pages.

Parameter Code	Description
00h	Errors corrected with substantial delays
01h	Errors corrected with possible delays
02h	Total rewrites or rereads
03h	Total errors corrected
04h	Total times correction algorithm processed
05h	Total bytes processed
06h	Total uncorrected errors
8000h	Vendor Unique

Figure 8-22 *Parameter Codes Supported*

Parameter codes 00h, 01h, and 04h will always return a value of zero.

DU, DS, TSD, ETC, TMC, and LP are collectively referred to as parameter control byte.

- DU–Disable Update: A zero value indicates that target shall update all log parameter values. A value of 1 indicates that target will not update the log parameter values except in response to LOG SELECT. This bit is set by the drive when accumulated values reach maximum. This is also returned set if the host set the bit in the last LOG SELECT command. The default is zero.

Note

For parameter types other than threshold and cumulative values, this bit is always zero.

- DS–Disable Save: Saving parameters is not supported; this bit will always be set to 1.
- TSD–Target Save Disable: Saving parameters is not supported; this bit will always be set to 1.
- ETC–Enable Threshold Comparison: ETC of 1 indicates that comparison to threshold is performed. ETC of zero indicates that this comparison is not performed. This bit is set to 1 by MODE SELECT. Default is zero.
- TMC–Threshold Met Criteria: This field is valid only if host sets ETC to 1. It determines the basis for comparison and is specified by host by LOG SELECT. If the result of comparison is true (cumulative = threshold) and MODE SELECT/SENSE control mode page RLEC bit is set 1, then a unit attention is

generated for all initiators. The sense key will be set to UNIT ATTENTION, ASC will be set to LOG EXCEPTION and ASCQ will be set to THRESHOLD CONDITION MET. If the RLEC bit in control mode page is zero then, UNIT ATTENTION will not be generated.

Note

This comparison is performed in real time. Therefore, you do not need to issue a Log Sense command to get the check condition. Once ETC is selected, RLEC bit in Control mode page, the check condition will be issued based on the criteria defined in the TMC bits if the criteria is met in Real time. Check condition will not identify for which parameter code the criteria is met. The user will need to issue Log Sense to read the counters to see for which parameter code criteria is met.

Code	Basis of Comparison
00b	Every update of the cumulative value
01b	Cumulative value equal to threshold value
10b	Cumulative value not equal to threshold value
11b	Cumulative value greater than threshold value

Figure 8-23 *Threshold Met Criteria*

- LP–List Parameter: This bit will always be set to zero as we treat the parameter codes as data counter. When the data counter reaches its defined maximum value, it shall not increment and DU bit shall be set to 1. If the data counter is at or reaches its maximum value during the execution of a command, the drive will complete the command. If the RLEC bit of CONTROL MODE PAGE is 1, the drive then will issue the status of CHECK CONDITION and set the sense key to RECOVERED ERROR with additional sense code set to LOG COUNTER AT MAXIMUM.

Parameter Length

This field specifies the number of bytes of the parameter value.

Parameter Value

This field is the actual value of this log parameter

8.4.8.3 Last n Error Events Page (07h)

This page returns one parameter at a time that consists of the ASCII text for the specified event log. The Parameter Number field in the CDB specifies the log event to return. The log events EEROM are numbered 0 to 255, after which the number wraps back to 0, and only a limited number of events are stored at a given time (up to 14). The log event returned is the one whose number is equal to, or the first one greater than, the Parameter Number specified in the CDB.

Parameter Code

Parameter code values are assigned from 0 to 27, where 0 would be the oldest event stored, and the highest parameter code returned would be the most recent event.

Hex ASCII String

The text of the parameter includes a "Packet #", which is a value from 0 to 255. This internal number is assigned when the packet is written into EEROM. Zero is normally the oldest packet, but packet numbers can wrap around from 255 to 0. For a detailed description of the packet string, see Appendix D.

Byte \ Bit	7	6	5	4	3	2	1	0
4	(MSB)	Parameter Length						
5								(LSB)
6	DU	DS	TSD	ETC	TMC		0	LP
7	Parameter Length							
8	(MSB)							
—		Hex ASCII string for Event n						
—								
n								(LSB)

Figure 8-24 *Last n Error Events Page*

8.4.8.4 Read/Write Compression Ratio Page Format (32h)

The Read/Write Compression Ratio page begins with a 4-byte header followed by the log parameter blocks of 6 or 8 bytes, depending on the parameter code selected.

Parameter Codes

The following parameter codes are supported for the Read/Write Compression Ratio page.

Parameter Code	Description
00h	Read Compression Ratio × 100
01h	Write Compression Ratio × 100
02h	MBytes Transferred to Host
03h	Bytes Transferred to Host
04h	MBytes Read from Tape
05h	Bytes Read from Tape
06h	MBytes Transferred from Host
07h	Bytes Transferred from Host
08h	MBytes Written to Tape
09h	Bytes Written to Tape

Figure 8-25 *Parameter Codes Supported*

Byte \ Bit	7	6	5	4	3	2	1	0
0	Reserved		Page Code					
1	Reserved							
2	(MSB) Additional Length							
3								(LSB)

Figure 8-26 *Read/Write Compression Ratio Page Header*

Additional Length

The additional length field specifies the number of bytes available and depends on the parameters requested

Parameter Block for Parameter Codes 00 and 01

Byte	Bit 7	6	5	4	3	2	1	0
0	(MSB)	Parameter Code						
1								(LSB)
2	DU	DS	TSD	ETC	TMC		Rsvd	LP
3	02h							
4	(MSB)	Compression Ratio x 100						
6								(LSB)

Figure 8-27 *Read/Write Compression Ratio LOG SENSE Page Format*

Parameter Control Byte

- DU–Disable Update: This bit is always zero.
- DS–Disable Save: Saving parameters is not supported; this bit will always be set to 1.
- TSD–Target Save Disable: Saving parameters is not supported; this bit will always be set to 1.
- ETC–Enable Threshold Comparison: Threshold checking is not supported on this page; this bit is always a zero.
- TMC–Threshold Met Criteria: Always a zero.
- LP–List Parameter: This bit will always be set to zero, as we treat the parameter codes as data counter.

Compression Ratio

The compression ratio is reported as the actual compression ratio times 100.

Parameter Block for Parameter Codes 02 through 09

Byte \ Bit	7	6	5	4	3	2	1	0
0	(MSB)	Parameter Code						
1								(LSB)
2	DU	DS	TSD	ETC	TMC		Rsvd	LP
3	04h							
4	(MSB)	Counter Value						
5								
6								
7								(LSB)

Figure 8-28 *Read/Write Bytes Transferred LOG SENSE Page Format*

Parameter Control Byte

- DU–Disable Update: This bit is always zero.
- DS–Disable Save: Saving parameters is not supported; this bit will always be set to 1.
- TSD–Target Save Disable: Saving parameters is not supported; this bit will always be set to 1.
- ETC–Enable Threshold Comparison: Threshold checking is not supported on this page; this bit is always a zero.
- TMC–Threshold Met Criteria: Always a zero.
- LP–List Parameter: This bit will always be set to zero as we treat the parameter codes as data counter.

Counter Value

These parameter codes provide a count of the number of bytes transferred since the current tape cartridge was inserted or since the last time the counters were reset via a MODE SELECT command.

Parameter codes 02 and 03 report the counts of bytes transferred from the tape drive to the initiator. Parameter code 02 reports the number of full megabytes transferred. Parameter code 03 reports the number of bytes less than a full megabyte that has been transferred. Multiplying the counter returned for parameter 02 by 1,048,576 and then adding the counter value returned for parameter 03 will give the actual total bytes transferred to the initiator.

Parameter codes 04 and 05 report the counts of bytes transferred from the tape to the buffer. Parameter code 04 reports the number of full megabytes transferred. Parameter code 05 reports the number of bytes less than a full megabyte that has been transferred. Multiplying the counter returned for parameter 04 by 1,048,576 and then adding the counter value returned for parameter 05 will give the actual total bytes transferred from tape to buffer.

Parameter codes 06 and 07 report the counts of bytes transferred from the initiator to the buffer. Parameter code 06 reports the number of full megabytes transferred. Parameter code 07 reports the number of bytes less than a full megabyte that has been transferred. Multiplying the counter returned for parameter 06 by 1,048,576 and then adding the counter value returned for parameter 07 will give the actual total bytes transferred from the initiator to the buffer.

Parameter codes 08 and 09 report the counts of bytes written to the tape. Parameter code 08 reports the number of full megabytes transferred. Parameter code 09 reports the number of bytes less than a full megabyte that has been transferred. Multiplying the counter returned for parameter 08 by 1,048,576 and then adding the counter value returned for parameter 09 will give the actual total bytes written to the tape.

8.4.9 MODE SELECT (15h)

Byte	Bit 7	6	5	4	3	2	1	0
0	Operation Code (15h)							
1	Logical Unit Number			PF	Reserved			SP(0)
2	Reserved							
3	Reserved							
4	Parameter List Length							
5	Unused (00)		Reserved				Flag	Link

Figure 8-29 *MODE SELECT CDB*

MODE SELECT enables the host to configure the device. Implementing MODE SELECT and MODE SENSE requires a certain amount of handshaking between the host and the drive. Before configuring the drive, the host should issue a MODE SENSE to get the current configuration and determine what parameters are configurable. The host interprets this information and may then issue MODE SELECT to set the drive to the host's preferred configuration.

The drive always powers up with its default configurations set. This is also true if the drive receives a BUS DEVICE RESET message or a hard reset through the RST line on the SCSI bus.

PF

The Page Format bit indicates that the data sent by the host after the MODE SELECT header and block descriptors complies with the definition of pages in the SCSI-2 specification. The SCSI-1 format will not be implemented, so this bit is required to be set. It is an ILLEGAL REQUEST to have page parameters while the PF bit is off.

SP

This bit must be zero. The save Parameters bit instructs the drive to save all savable pages. This is not supported.

PARAMETER LIST LENGTH

This specifies the length in bytes of the MODE SELECT parameter list that is transferred during the DATA OUT phase. A zero Parameter List Length indicates that no data is transferred.

8.4.9.1 MODE SELECT Parameter List

The MODE SELECT parameter list shown below, contains a 4-byte header, followed by one 8-byte block descriptor.

Byte \ Bit	7	6	5	4	3	2	1	0
0	Reserved							
1	Media Type							
2	WP	Buffered Mode			Speed			
3	Block Descriptor Length (08h)							

Block Descriptor

Byte								
0	Density Code							
1	(MSB)							
2	Number of Blocks (000000h)							
3								(LSB)
4	Reserved							
5	(MSB)							
6	Block Length							
7								(LSB)

Page Descriptor

Byte								
0	PS (0)	0	Page Code					
1	Additional Length							
2	Page Defined or Vendor-Unique Parameter Bytes							

Figure 8-30 *MODE SELECT Parameter List*

Media Type

This field is ignored for Mode Select parameter.

WP

This field is ignored for Mode Select parameter.

Buffered Mode

The drive will implement Immediate Reporting on WRITE commands through Buffered mode.

If the field is zero, then the drive does not report a GOOD status on WRITE commands until the data blocks are actually written to tape. If the Buffered Mode field is one, then the drive reports GOOD status on WRITE commands as soon as the data block has been transferred to the buffer. This is the default configuration for the drive.

If Buffered mode is not used, the tape drive will suffer a significant degradation in performance, and maybe capacity as well, depending on tape format, block size and compression. If writing 2.6 or 6.0 GByte formats, if the block size is a multiple of 4 Kbytes, there is no capacity loss. When using the 10 GByte format, if compression is disabled and the block size is a multiple of 8 Kbytes, there is no capacity loss.

When using the 10 GByte format and compression enabled, not having buffered mode enabled will cause some capacity loss, depending on compression ratios. This is because the block packing feature is essentially disabled by turning off buffered mode.

If this field is greater than 1, the command will be rejected with a Check Condition, with a Sense Key of ILLEGAL REQUEST.

Speed

The tape drive supports only one speed, the default speed.

Block Descriptor Length

This specifies the length in bytes of all the block descriptors. Since the drive only allows one block descriptor, this value must be 8 or 0. Any other value causes a CHECK CONDITION status with an ILLEGAL REQUEST sense key to be returned.

Density Code

This field should match the current density of the media, or will be set to zero if the density is unknown.

- 00h - use default density
- 0Ah - 6667 bpi MFM serial cart. tape X3B5/86-199 (Read only) (CompacTape)
- 16h - 10000 bpi MFM serial cart tape X3.193-1990 (Read only) (CompacTape II)
- 17h - 42500 bpi MFM serial cart tape X3B5/91-174 - 2.6 GB (CompacTape III)
- 18h - (Same as 17h but with 56 track pairs vs. 24) - 6.0 GB (CompacTape III)
- 19h - 62500 bpi, 64 track pairs, serial cart tape - 10 GB (CompacTape III)
- 7Fh - No change from previous density (NOP)

- 80h - 62500 bpi, 64 track pairs, serial cart tape - 10 GB (CompacTape III) (Without compression)
- 81h - 62500 bpi, 64 track pairs, serial cart tape -20 GB (CompacTape III) (With compression)

Note

1. If EEROM parameter EnaThirdPtyDens is set, which is true by default, Mode Select command does not reject non-supported density code. The third party density code Selected is translated into default density code (i.e. 00h)
2. Default density is the optimum density supported by the specific media. For CompacTape III, it is 20 GB (with compression).

Number of Blocks

This MODE SENSE field will be sent as zero, indicating that all of the remaining logical blocks on the tape will have the medium characteristics specified by the block descriptor.

Block Length

This specifies the length in bytes of each logical block transferred over the SCSI bus. A block length of zero indicates that the length is variable (specified in the I/O command). Any other value indicates the number of bytes per block to use for read, write and verify type commands that specify a "Fixed" bit of 1 (i.e., fixed block mode) which also causes the transfer length in the CDB to be defined as a block count.

8.4.9.2 MODE SELECT Pages

Following the Block Descriptor are the MODE SELECT pages, which set the device parameters. Each page has a 2-byte header which identifies the page code and indicates the number of bytes in that page.

The supported Page Codes are as follows:

Page Code	Description	Sense/Select
0Ah	Control Mode Page	Both
0Fh	Data Compression Page	Both
10h	Device Configuration	Both
02h	Disconnect/Reconnect	Both
01h	Error Recovery Page	Both
11h	Medium Partition	Both
3Eh	EEPROM Parameter	Both

Figure 8-31 *MODE SELECT Pages Supported*

PS Bit

For the MODE SELECT command this bit is reserved. For the MODE SENSE command, a Parameters Savable (PS) bit of one indicates that the page can be saved in nonvolatile memory by the drive. If the PS bit is zero, the supported parameters cannot be saved. (Saveable pages are not supported.)

Additional Page Length

This indicates the number of bytes in that page. However, the value does not include bytes 0 and 1. The length is returned on MODE SENSE and must subsequently be set to the same value when performing MODE SELECT. If the page length does not match that expected by the drive, a CHECK CONDITION status is returned with the sense key set to ILLEGAL REQUEST.

The drive also returns a CHECK CONDITION status with an ILLEGAL REQUEST sense key if the host sends an unsupported Page Code, or a Page field with values not supported or changeable. In this case, no parameters will be changed by the command.

8.4.9.3 Control Mode Page (0Ah)

The control mode page provides controls over several features such as tagged queuing, extended contingent allegiance, asynchronous event notification, and error logging.

Byte \ Bit	7	6	5	4	3	2	1	0
0	RSVD		Page Code					
1	Page Length							
2	RSVD							RLEC
3	Queue Algorithm Modifier				Reserved		QErr	DQue
4	EECA	Reserved				RAENP	UAAENP	EAENP
5	Reserved							
6	(MSB) Ready AEN Holdoff Period							
7								(LSB)

Figure 8-32 *Control Mode Page (0Ah)*

A report log exception condition (RLEC) bit of one specifies the target shall report log exception conditions. An RLEC bit of zero specifies the target shall not report log exception conditions.

Page Code

The Page Code identifies the type of MODE SELECT page being transferred. This is the Control Mode Page. The valid value for Page Code is (0Ah).

Page Length

The Page Length indicates the number of bytes in the Control Mode Page that follow this byte. The valid value for this byte is (06h).

RLEC

The RLEC bit works with the READ/WRITE Error Log Sense Page. Refer to the previous section Read/Write Error Log SENSE Page Format (Page 2 and 3) under the TMC bit description.

The RLEC bit indicates whether the DLT2000 should return Check Condition status with the sense key set to Unit Attention (6h) when one of its write and read error counters of the log pages reaches a specified threshold as follows: (See LOG SELECT command section on how to change the threshold.)

0 - Do not return Unit Attention when a threshold condition is met

1 - Return Unit Attention when a threshold condition is met

Queue Algorithm Modifier

This field must be 0.

QErr (Queue Error)

This bit must be 0.

DQue (Disable Queuing)

This bit must be 0.

EECA (Enable Extended Contingent Allegiance)

The DLT2000 does not support extended contingent allegiance, so this bit must be 0.

RAENP (Ready AEN Permission)

The DLT2000 does not support asynchronous event notification (AEN), so this bit must be 0.

UAAENP (Unit Attention AEN Permission)

The DLT2000 does not support asynchronous event notification, so this bit must be 0.

EAENP (Error AEN Permission)

The DLT2000 does not support asynchronous event notification, so this bit must be 0.

Ready AEN Holdoff Period

The DLT2000 does not support asynchronous event notification, so this field must be 0.

8.4.9.4 Data Compression Page (0Fh)

The Data Compression Page specifies parameters for the control of data compression. This page allows you to turn DLT2000 compressed format on and off independently of the tape's position and allows you to enable or disable decompression of DLT2000 compressed data during write operations.

Byte \ Bit	7	6	5	4	3	2	1	0
0	RSVD		Page Code					
1	Page Length							
2	DCE	DCC	Reserved					
3	DDE	RED		Reserved				
4–7	(MSB) Compression Algorithm (LSB)							
8–11	(MSB) Decompression Algorithm (LSB)							
12–15	Reserved							

Figure 8-33 *Data Compression Page (0Fh)*

Page Code

The Page Code identifies the type of MODE SELECT page being transferred. This is the Data Compression Page. The valid value for the Page Code is (0Fh).

Page Length

The Page Length indicates the number of bytes in the Data Compression Page that follow this byte. The valid value for this byte is (0Eh).

DCE (Data Compression Enable)

The Data Compression Enable bit specifies whether the DLT2000 should enable or disable data compression. When the DCE bit is 1, the DLT2000 starts in compressed format.

DCC (Data Compression Capable)

The Data Compression Capable bit is used by the MODE SENSE command to indicate that the DLT2000 supports data compression.

DDE (Data Decompression Enable)

When the DLT2000 reads compressed data from tape, it automatically decompresses the data before sending it to the initiator. Data compression is always enabled, so this bit must be set to 1 (enable data decompression).

RED (Report Exception on Decompression)

The DLT2000 does not report exceptions on decompression (boundaries between compressed and uncompressed data). The RED field must be (00h).

Compression Algorithm

The Compression Algorithm field indicates which compression algorithm the DLT2000 will use to process data from the initiator when the DCE bit (byte 02, bit 7) is 1. The only value currently supported for this field is 10h.

Note

Specifying a value other than (10h) for this field causes the DLT2000 to return Check Condition status with the sense key set to Illegal Request (5h).

Decompression Algorithm

The Decompression Algorithm field indicates which decompression algorithm the DLT2000 will use when decompressing data encountered on the tape. The only value currently supported for this field is (10h).

Note

Specifying a value other than 10h for this field causes the DLT2000 to return Check Condition status with the sense key set to Illegal Request (5h).

8.4.9.5 Device Configuration Page (10h)

The drive supports the Device Configuration Page which has the following format:

Byte \ Bit	7	6	5	4	3	2	1	0
0	PS (0)	0	Page Code(10h)					
1	Additional Page Length (0Eh)							
2	Res	CAP	CAF	Active Format				
3	Active Partition							
4	Write Buffer Full Ratio							
5	Read Buffer Empty Ratio							
6	(MSB) Write Delay Time							
7	Write Delay Time (LSB)							
8	DBR	BIS	RSmk	AVC	SOCF		RBO	REW
9	Gap Size							
10	EOD Defined			EEG	SEW	Reserved		
11	(MSB) Buffer Size at Early Warning (optional)							
12	Buffer Size at Early Warning (optional)							
13	Buffer Size at Early Warning (optional) (LSB)							
14	Select Data Compression Algorithm							
15	Reserved							

Figure 8-34 *Device Configuration Page Format*

In this page, only the Write Delay Time and Select Data Compression Algorithm parameters are changeable.

PS

Must be zero.

CAP, CAF, Active Format

These fields are not supported and must be zero on MODE SELECT.

Active Partition

Only partition 0 is supported. Setting this field to any other value will be rejected by the drive with a CHECK CONDITION status and the ILLEGAL REQUEST sense key set.

Write Buffer Full Ratio and Read Buffer Empty Ratio

These indicate how full/empty the buffer memory should be before restarting the writing/reading of the media. The DLT2000 will set these fields to zero (unused) because it uses an automatic, adaptive mechanism to dynamically adjust its Full/Empty ratios according to the average data rates over the SCSI bus.

Write Delay Time

This indicates the maximum time that the drive will wait with a partially full buffer before forcing the data to tape (100 ms increments). The buffer Full/Empty ratio, which is dynamic, can cause data to be written sooner than the Write Delay time would indicate. The Write Delay Time defaults to 200 (C8h). This causes the buffer to be flushed in 20 seconds. Maximum value is 6500 (1964h) and the minimum is 15 (0Fh). This represents delays from almost 11 minutes down to 1.5 seconds.

Values between 0 and 15, on a MODE SELECT, are rounded down to 0. This causes the data to go straight to the media without delay.

Byte 8:

DBR - set to 0 (data buffer recovery not supported)

BIS - set to 1 (Block Identifiers Supported in media format)

RSmk - set to 0 (Setmarks not supported)

AVC - set to 0

SOCF - set to 0

RBO - set to 0

REW - set to 0 (Do not report Early Warning EOM on reads)

Gap Size

This field is not used and is set to zero.

EOD Defined

This field is set to (00h); any other value will be rejected by the drive.

EEG

The Enable EOD Generation bit is set to indicate that the drive will generate an EOD. The drive generates an EOD mark before any change of direction following a write-type operation. This bit is ignored on MODE SELECT.

SEW and Buffer Size At Early Warning

The Synchronize at Early Warning bit is set to 1. Buffer Size at EW is not supported and must be zero.

Select Data Compression Algorithm

One enables data compression; a zero disables it.

The front panel setting will override what is specified in the MODE SELECT, but no error will result. If the front panel is returned to automatic mode, the value from the last MODE SELECT command will determine whether compression will be used or not.

8.4.9.6 Disconnect/Reconnect Page (02h)

The drive shall support the Disconnect/Reconnect Page which has the following format:

Byte \ Bit	7	6	5	4	3	2	1	0
0	PS (0)	0	Page Code(02h)					
1	Additional Page Length (0Eh)							
2	Buffer Full Ratio							
3	Buffer empty Ratio							
4	(MSB) Bus Inactivity Limit							
5								(LSB)
6	(MSB) Disconnect time Limit							
7								(LSB)
8	(MSB) Connect Time Limit							
9								(LSB)
10	(MSB) Maximum Burst Size							
11								(LSB)
12	Reserved						DTDC	
13	Reserved							
14	Reserved							
15	Reserved							

Figure 8-35 *Disconnect/Reconnect Page Format*

In this page, only the Maximum Burst Size parameter is changeable.

The following parameters in this page are supported:

Maximum Burst Size

This value specifies the maximum amount of data that will be transferred without disconnecting. A value of zero sets no limit. This value is in units of 512 bytes. For example, a value of 8 means 4k bytes. Values that are not multiples of 8 are rounded up to the closest multiple of 8.

Data Transfer Disconnect Control (DTDC)

The DTDC field defines further restrictions on when a disconnect is permitted.

DTDC	Description
00b	Data transfer disconnect control is not used. Disconnect is controlled by the other fields in this page
01b	A target does not attempt to disconnect once the data transfer of a command has started until all data the command is to transfer has been transferred.
10b	Reserved
11b	A target does not attempt to disconnect once the data transfer of a command has started, until the command is complete.

Figure 8-36 *Data Transfer Disconnect Control*

If DTDC is non-zero and the maximum burst size is non-zero, the DLT2000 returns CHECK CONDITION status. The sense key is set to ILLEGAL REQUEST and the additional sense code set to ILLEGAL FIELD IN PARAMETER LIST.

8.4.9.7 Medium Partition Page (11h)

The drive supports the Medium Partitions Parameter Page, which has the following format:

Byte \ Bit	7	6	5	4	3	2	1	0
0	PS (0)	0	PageCode(11h)					
1	Additional Page Length (06)							
2	Maximum Additional Partitions							
3	Additional Partitions Defined							
4	FDP	SDP	IDP	PSUM		Reserved		
5	Medium Format Recognition (01)							
6	Reserved							
7	Reserved							

Figure 8-37 *Medium Partition Page Format*

Maximum Additional Partitions

No additional partitions are supported, this field must be zero.

Additional Partitions Defined

The field specifies the number of additional partitions to be defined for the tape based on the settings of the SDP and IDP bits. The maximum allowed is the value returned in the Maximum Additional Partitions field. Since only one partition is supported, this field must be zero.

Option Flags

FDP - Fixed Data Partitions bit must be zero.

SDP - Select Data Partitions bit must be zero.

IDP - Initiator Defined Partitions bit must be zero.

PSUM - Partition Size Unit of Measure field must be zero.

Medium Format Recognition

This field is only valid on a MODE SENSE and is set to 01h indicating that automatic Format Recognition is supported.

8.4.9.8 Read/Write Error Recovery Page (01h)

The drive shall support the Error Recovery Page which has the following format:

Byte \ Bit	7	6	5	4	3	2	1	0
0	PS (0)	0	Page Code(01h)					
1	Additional Page Length (0Ah)							
2	rsvd	rsvd	TB	rsvd	EER	PER	DTE	DCR
3	Read Retry Count							
4	Reserved							
5	Reserved							
6	Reserved							
7	Reserved							
8	Write Retry Count							
9	Reserved							
10	Reserved							
11	Reserved							

Figure 8-38 *Error Recovery Page Format*

In this page, only the Post Error (PER) flag parameter is changeable. If PER is set, Check Conditions will be created, with Sense Key of Recovered Error, and VU Sense Data detailing the cause. Normally, these events should be rare, and only occur if the recovered write or read retry rates reach excessive levels.

Option Flags

- TB - The Transfer Block (when not fully recovered) function is not supported.
- EER - The Enable Early Recovery function is always enabled.
- PER - The Post Error bit turns on reporting of Check Condition to report recovered read/write errors. The default setting of this bit is zero.
- DTE - The Disable Transfer on Error feature is not supported so this bit must be zero.
- DCR - The Disable ECC Correction bit feature is not supported so this bit must be zero.

Read Retry Count

This field reports the maximum number of rereads that are done before declaring an unrecoverable error.

Write Retry Count

This field reports the maximum number of overwrite retries that will be performed before declaring an unrecoverable error.

8.4.9.9 EEROM Vendor Unique Page (3Eh)

The drive shall support a vendor unique page, which you can use to modify savable parameters. Only one savable parameter may be changed per Mode Select command. It has the following format:

0	PS	0	Page Code
1	Additional Page Length		
2	ASCII String of parameter name and value		

Figure 8-39 *EEROM Vendor Unique Page Format*

The ASCII string has a parameter name, followed by one or more space characters, a parameter value, and an ASCII line feed or null character. When the string is parsed the parameter value will be interpreted as indicated in the following table. The parameter name may be in upper- or lowercase.

Table 8-3 *EEROM Vendor Unique Page Parameters*

Name	Value Rep.	Default	Skip Default	Length (Bytes)	Usage
VENDORID	ASCII	DEC	1	8	Vendor Identification field in Inquiry Data
PRODUCTID	ASCII	DLT2000	1	16	Product Identification field in Inquiry Data
FORCEDENSITY	ASCII Decimal	0	0	1	0=automatic[2], 1=DLT260, 2=DLT600, 3=DLT2000
FORCECOMP	ASCII Binary	0	0	1	0=automatic[2], 1=Always compress unless front panel selection disables it
DEFAULTCOMPON	ASCII Binary	1	0	1	0=Compression defaulted off on powerup/reset, 1=Compression defaulted to on, on powerup/reset
DEFFIXEDBLKLEN	ASCII Decimal	0	0	8	Default fixed block size
ENBINQMEDCHGR	ASCII Binary	0	0	1	0=disable media changer bit, 1=enable media changer bit in byte 6 of inquiry data
LOADERLUN	ASCII Decimal	1	0	1	1-7 = LUN to report media loader device on
REWINDONRESET	ASCII Binary	1	0	1	0=Do not rewind on Bus Reset or BDR msg (Caution: May have partial block data written to the tape, if reset happens during writing.) 1=Rewind the media to BOT on reset.
ENALDRAUTOLD	ASCII Binary	1	0	1	To turn on/off sequential loading with loader.

[1]Parameter setting, if set, remains after the firmware update.

[2]Parameter is not forced to a special format, which is decided by the parameters selected in MODE SELECT.

Table 8-3 *EEROM Vendor Unique Page Parameters (cont'd)*

Name	Value Rep.	Default	Skip Default[1]	Length (Bytes)	Usage
DISLDRAUTOLDMC	ASCII Binary	1	0	1	To partially disable sequential loading with loader if any media loader command has been received.
ENAPARERRRETRY	ASCII Binary	0	0	1	To turn on/off parity error etry feature.
ENAMODEPG22	ASCII Binary	0	0	1	To enable vendor unique Data Compression (Status Mode Page).
NODISCONFXDBLK	ASCII Binary	1	0	1	To turn on/off feature of not to disconnect on every fixed block data transfer.
FOURLAMPMODEL	ASCII Binary	0	1	1	If turned on, front panel SELECT button can only select 2.6 GB, 10.0 GB, or Compress (done with 10.0 GB only)
PROTECTDIRONWP	ASCII Binary	0	0	1	To protect tape directory if the cartridge write-protect switch is in write protect position.
ENACLNGLTRPT	ASCII Binary	1	0	1	To report error status if cleaning light is on.
LONGXPORTPAGE	ASCII Binary	1	0	1	To report 18 or 6 bytes medium transport element status descriptor if parameter is on or off.
FORCEEEREBUILD	ASCII Binary	0	0	1	To force all the EEROM parameters reset to default, if set
SCSIINQVS	ASCII Binary	0	0	1	To return vendor unique inquiry string, if set
DEFSEW	ASCII Binary	1	0	1	To set default SEW parameter
ENAINITSYNCNEG	ASCII Binary	0	0	1	To enable target initiated synchronous negotiation, if set.

Table 8-3 *EEROM Vendor Unique Page Parameters (cont'd)*

Name	Value Rep.	Default	Skip Default[1]	Length (Bytes)	Usage
REPORTRCVDPERRS	ASCII Binary	1	0	1	To report recovered error if parity error has been retried successfully, if set.
ENATHIRDPTYDENS	ASCII Binary	1	0	1	To make non-DLT density code act as the default density (same as density code 0), if set.
FORCEREADSILI	ASCII Binary	0	0	1	To make variable Read command handled as if the SILI bit is set, if set.
CACHETMS	ASCII Decimal	0	0	1	0,1=Don't cache filemarks unless Imm bit is 1; 2=Cache if not 2 in a row unless Imm bit is 1; 3=Always cache filemarks
LDRCYCLERESET	ASCII Binary	0	0	1	To cause the first cartridge to be loaded if unloading the last cartridge when the loader product is operated in sequential mode ,if set.
ENAREPDECOMP	ASCII Binary	0	0	1	If set and the drive is in Read mode, the decompression algorithm field in Data Compression mode page will be set if the last block requested by the host was decompressed, otherwise it is cleared.

This is an example of an EEROM vendor unique page that will modify the VENDORID parameter to "XXXYY."

0	0	0	Page Code (3EH)
1	Page Length (0FH)		
2	"v" (76H)		
3	"e" (65H)		
4	"n" (6EH)		
5	"d" (64H)		
6	"o" (6FH)		
7	"r" (72H)		
8	"i" (69H)		
9	"d" (64H)		
10	" " (20H)		
11	"X" (58H)		
12	"X" (58H)		
13	"X" (58H)		
14	"Y" (59H)		
15	"Y" (59H)		
16	<LF> (0AH) or (00H)		

Figure 8-40 *EEROM Vendor Unique Page Example 1*

This is an example of an EEROM vendor unique page that will modify the FORCEDENSITY parameter to 1.

0	0	0	Page Code (3EH)
1	Page Length (0FH)		
2	"F" (46H)		
3	"O" (4FH)		
4	"R" (52H)		
5	"C" (43H)		
6	"E" (45H)		
7	"D" (44H)		
8	"E" (45H)		
9	"N" (4EH)		
10	"S" (53H)		
11	"I" (49H)		
12	"T" (54H)		
13	"Y" (59H)		
14	" " (20H)		
15	"1" (31H)		
16	<LF> (0AH) or (00H)		

Figure 8-41 *EEROM Vendor Unique Page Example 2*

8.4.9.10 MODE SELECT Changeable Parameters

The following table lists the changeable mode parameters and their minimum and maximum values allowed. See the previous definitions for the units that are used. Parameter rounding is supported for all parameters except the block descriptor length.

Table 8-4 *Changeable Mode Parameters*

Page: Parameter	Default	Minimum	Maximum
Header: Buffered Mode, Device Specific Byte	1	0	1
Block Descriptor Length	08h	00h	08h
Block Descriptor: Block Length			
2.6 GB and 6.0 GB mode	0	0	40000h
10.0 GB and 20.0 GB mode	0	0	FFFFFFh
Read-Write Error Recovery (01h): PER Bit	0	0	1
Control Mode (0Ah): RLEC	0	0	1
Data Compression (0Fh): DCE	1	0	1
Disconnect-Reconnect (02h): Maximum Burst Size	0080h	0000h	FFFFh
Disconnect-Reconnect (02h): DTDC	0	0	3
Device Configuration (10h): Write Delay Time	C8h	Fh	1964h
Device Configuration (10h): SEW	1	0	1
Device Configuration (10h): Select Data Compression Algorithm	1	0	1

8.4.10 MODE SENSE (1Ah /5Ah)

MODE SENSE allows the drive to report its media, current or changeable configuration parameters to the host. It is a complementary command to MODE SELECT.

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (1Ah)							
1	Logical Unit Number			Reser.	DBD	Reserved		
2	PC		Page Code					
3	Reserved							
4	Allocation Length							
5	Unused		Reserved				Flag	Link

Figure 8-42 *MODE SENSE CDB (6)*

The DLT2000 products also support the 10-byte MODE SENSE, which is required to request the VU EEROM Parameter page because of the large amount of data that needs to be passed back. MODE SENSE (10) can be used to retrieve the other pages as well. Note that MODE SENSE (10) returns a different format of descriptor data.

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (5Ah)							
1	Logical Unit Number			Rsvd	DBD	reserved		
2	PC		Page Code					
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	(MSB) Allocation Length							
8								(LSB)
9	Unused		Reserved				Flag	Link

Figure 8-43 *MODE SENSE CDB (10)*

DBD

If the Disable Block Descriptors bit is zero, the device returns the Block Descriptor Data. If set, then the Block Descriptor information is not returned.

PC

The Page Control field indicates the type of page parameter values to be returned to the host as shown in the following table:

PC	Description
0 0	Report Current Values
0 1	Report Changeable Values
1 0	Report Default Values
1 1	Report Saved Values

Figure 8-44 *MODE SENSE Page Control Definition*

The Additional Page Length field of each page returned by the drive indicates the number of bytes supported for that page.

Page Code

This allows the host to select any specific page, or all the pages supported by the drive.

Allocation Length

The Allocation Length field specifies the number of bytes that the host has allocated for returned MODE SENSE data. An Allocation Length of zero means that the drive will return no MODE SENSE data. This is not considered an error and GOOD status is returned.

8.4.10.1 MODE SENSE Parameter List

The MODE SENSE (6) data contains a 4-byte header followed by one 8-byte block descriptor, followed by zero or more variable length pages, depending on the Page Code and the Allocation Length.

Byte	7	6	5	4	3	2	1	0
0	Sense Data Length							
1	Media Type							
2	WP	Buffered Mode			Speed (0)			
3	Block Descriptor Length (08h)							LSB)

Figure 8-45 *MODE SENSE (6) Data Header*

The MODE SENSE (10) data contains an 8-byte header followed by one 8-byte block descriptor, followed by zero or more variable length pages. The MODE SENSE (10) data header format is as follows:

Byte	7	6	5	4	3	2	1	0
0	(MSB)							
1	Mode Sense Data Length							(LSB)
2	Media Type							
3	WP	Buffered Mode			Speed (0)			
4	Reserved							
5	Reserved							
6	(MSB)							
7	Block Descriptor Length (8)							(LSB)

Figure 8-46 *MODE SENSE (10) Data Header*

Byte \ Bit	7	6	5	4	3	2	1	0
0	Density Code							
1	(MSB) Number of Blocks (000000h)							
2								
3								(LSB)
4	Reserved							
5	(MSB) Block Length							
6								
7								(LSB)

Figure 8-47 *MODE SENSE Block Descriptor*

Byte \ Bit	7	6	5	4	3	2	1	0
0	PS	0	Page Code					
1	Additional Page Length							
2	Page Defined or Vendor-Unique Parameter Bytes							

Figure 8-48 *MODE SENSE Page Descriptor*

Data Length

The Sense Data Length specifies the length in bytes of the following MODE SENSE data that is available to be transferred during DATA IN phase. The Sense Data Length does not include itself.

Media Type

This field indicates the media type. The value is as follows:

00h: Unknown media or media not present.

81h: Cleaning tape.

82h: CompacTape or CompacTape II

83h: CompacTape III

WP

A Write-Protected bit of zero indicates that the tape is write-enabled. A Write-Protected bit of one indicates that the tape is write-protected.

Buffered Mode

The drive implements Immediate Reporting on WRITE commands through Buffered mode.

If the field is zero, then the drive does not report a GOOD status on WRITE commands until the data blocks are actually written to tape. If the Buffered Mode field is one, then the drive reports GOOD status on WRITE commands as soon as the data block has been transferred to the buffer. This is the default configuration for the drive. If Buffered mode is not used, the tape drive will suffer a significant degradation in performance, but not capacity.

Speed

The tape drive supports only one speed, the default speed.

Block Descriptor Length

This specifies the length in bytes of all the block descriptors. Since the drive only allows one block descriptor, this value will be 8.

Density Code

This field matches the current density of the media, or zero if the density is unknown.

- 00h - use default density
- 0Ah - 6667 bpi MFM serial cart. tape X3B5/86-199 (Read only) (CompacTape)
- 16h - 10000 bpi MFM serial cart tape X3.193-1990 (Read only) (CompacTape II)
- 17h - 42500 bpi MFM serial cart tape X3B5/91-174 - 2.6 GB (CompacTape III)
- 18h - (Same as 17h but with 56 track pairs vs. 24) - 6.0 GB (CompacTape III)
- 19h - 62500 bpi, 64 track pairs, serial cart tape - 10 GB (CompacTape III)
- 7Fh - No change from previous density (NOP)
- 80h - 62500 bpi, 64 track pairs, serial cart tape - 10 GB (CompacTape III) (Without compression)
- 81h - 62500 bpi, 64 track pairs, serial cart tape -20 GB (With compression)

Number of Blocks

This field will be sent as zero, indicating that all of the remaining logical blocks on the tape will have the medium characteristics specified by the block descriptor.

Block Length

This specifies the length in bytes of each logical block transferred over the SCSI bus. A block length of zero indicates that the length is variable (as specified in the I/O command). Any other value indicates the number of bytes per block that will be used for read, write, and verify type commands that specify a "Fixed" bit of 1 (fixed block mode).

8.4.10.2 MODE SENSE Pages

Following the block descriptor are the MODE SELECT pages, which set the device parameters. Each page has a 2-byte header which identifies the page code and indicates the number of bytes in that page.

The supported Page Codes are:

Page Code	Description	Sense/Select
00h	No Requested Page	Sense
0Ah	Control Mode Page	Both
0Fh	Data Compression Page	Both
10h	Device Configuration	Both
02h	Disconnect/Reconnect	Both
01h	Error Recovery Page	Both
11h	Medium Partition	Both
3Eh	EEPROM parameter	Both
3Fh	All Pages	Sense

Figure 8-49 *MODE SENSE Pages Supported*

PS Bit

A Parameters Savable (PS) bit of one indicates that the page can be saved in nonvolatile memory by the drive. If the PS bit is zero, the supported parameters cannot be saved. (Saveable pages are not supported.)

Additional Page Length

This indicates the number of bytes in that page. However, the value does not include bytes 0 and 1. The length is returned on MODE SENSE and must subsequently be set to the same value when performing MODE SELECT.

8.4.10.3 Control Mode Page (0Ah)

The Control Mode Page allows you to determine whether the DLT2000 will return Check Condition status when one of its write and read error counters reaches a specified threshold.

<table>
<tr><th></th><th colspan="8">Bit</th></tr>
<tr><th>Byte</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>0</td><td colspan="2">RSVD</td><td colspan="6">Page Code</td></tr>
<tr><td>1</td><td colspan="8">Page Length</td></tr>
<tr><td>2</td><td colspan="7">RSVD</td><td>RLEC</td></tr>
<tr><td>3</td><td colspan="4">Queue Algorithm Modifier</td><td colspan="2">Reserved</td><td>QErr</td><td>DQue</td></tr>
<tr><td>4</td><td>EECA</td><td colspan="4">Reserved</td><td>RAENP</td><td>UAAENP</td><td>EAENP</td></tr>
<tr><td>5</td><td colspan="8">Reserved</td></tr>
<tr><td>6</td><td colspan="8" rowspan="2">(MSB)
Ready AEN Holdoff Period
(LSB)</td></tr>
<tr><td>7</td></tr>
</table>

Figure 8-50 *Control Mode Page (0Ah)*

Page Code

The Page Code identifies the type of MODE SENSE page being transferred. The value returned for the Page Code is (0Ah) (Control Mode Page).

Page Length

The Page Length indicates the number of bytes in the Control Mode Page that follow this byte. The value returned for this byte is (06h).

RLEC (Report Log Exception Condition)

The RLEC bit indicates whether the DLT2000 should return Check Condition status with the sense key set to Unit Attention (6h) when one of its write and read error counters reaches a specified threshold, as follows:

0 - Do not return Unit Attention when a threshold condition is met

1 - Return Unit Attention when a threshold condition is met

Queue Algorithm Modifier

The value returned for this field is 0.

QErr (Queue Error)

The value returned for this field is 0.

DQue (Disable Queuing)

The value returned for this field is 0.

EECA (Enable Extended Contingent Allegiance)

The DLT2000 does not support extended contingent allegiance, so the value returned for this field is 0.

RAENP (Ready AEN Permission)

The DLT2000 does not support asynchronous event notification (AEN), so the value returned for this field is 0.

UAAENP (Unit Attention AEN Permission)

The DLT2000 does not support asynchronous event notification, so the value returned for this field is 0.

EAENP (Error AEN Permission)

The DLT000xt does not support asynchronous event notification, so the value returned for this field is 0.

Ready AEN Holdoff Period

The DLT2000 does not support asynchronous event notification, so the value returned for this field is 0.

8.4.10.4 Device Configuration Page (10h)

The drive shall support the Device Configuration Page which has the following format:

Byte	Bit 7	6	5	4	3	2	1	0
0	PS	0	Page Code(10h)					
1	Additional Page Length (0Eh)							
2	Res	CAP	CAF	Active Format				
3	Active Partition							
4	Write Buffer Full Ratio							
5	Read Buffer Empty Ratio							
6	(MSB) Write Delay Time							
7								(LSB
8	DBR	BIS	RSmk	AVC	SOCF		RBO	REW
9	Gap Size							
10	EOD Defined			EEG	SEW	Reserv ed		
11	(MSB)							
12	Buffer Size at Early Warning (optional)							
13								(LSB)
14	Select Data Compression Algorithm							
15	Reserved							

Figure 8-51 *Device Configuration Page Format*

PS

Saving parameters is not supported and will be zero.

CAP, CAF, Active Format

These fields are not supported and will be zero.

Active Partition

Only partition 0 is supported.

Write Buffer Full Ratio and Read Buffer Empty Ratio

These indicate how full/empty the buffer memory should be before restarting the writing/reading of the media. The DLT2000 will set these fields to zero (unused) because it uses an automatic, adaptive mechanism to dynamically adjust its full/empty ratios according to the average data rates over the SCSI bus.

Write Delay Time

This indicates the maximum time that the drive will wait with a partially full buffer before forcing the data to tape (100 ms increments). Note that the buffer full/empty ratio, which is dynamic, can cause data to be written sooner than the Write Delay time would indicate. The Write Delay Time defaults to 200 (C8h). This causes the buffer to be flushed in 20 seconds. Maximum value is 6500 (1964h) and the minimum is 15 (Fh). This represents delays from almost 11 minutes down to 1.5 seconds.

Byte 8:

DBR–set to 0 (Data buffer recovery not supported)

BIS–set to 1 (Block Identifiers Supported in media format)

RSmk–set to 0 (Setmarks not supported)

AVC–set to 0

SOCF–set to 0

RBO–set to 0

REW–set to 0 (Do not report Early Warning EOM on reads)

Gap Size

This field is not used and is set to zero.

EOD Defined

This field is set to 00h.

EEG

The Enable EOD Generation bit is set to indicate that the drive will generate an EOD. The drive generates an EOD mark before any change of direction following a write-type operation.

SEW and Buffer Size at Early Warning

The Synchronize at Early Warning bit is set to 1. Buffer Size at EW fields are not supported and will be zero.

Select Data Compression Algorithm

One enables data compression; zero disables it.

8.4.10.5 Data Compression Page (0Fh)

The Data Compression Page specifies parameters for the control of data compression.

Byte \ Bit	7	6	5	4	3	2	1	0
0	PS	RSVD	Page Code					
1	Page Length							
2	DCE	DCC	Reserved					
3	DDE	RED		Reserved				
4	(MSB)							
4–7	Compression Algorithm							
7								(LSB)
8	(MSB)							
8–11	Decompression Algorithm							
11								(LSB)
12–15	Reserved							

Figure 8-52 *Data Compression Page)*

PS (Parameters Savable)

The Parameters Savable bit indicates if the MODE SENSE parameter data contained in this page is savable. The DLT2000 does not support this feature. The value returned for this bit is 0.

Page Code

The Page Code identifies the type of MODE SENSE data being transferred. The value returned for this field is 0Fh (Data Compression Page).

Page Length

The Page Length indicates the number of Data Compression Page bytes that follow this byte. The value returned for this byte is 0Eh.

DCE (Data Compression Enable)

The Data Compression Enable bit indicates whether data compression is enabled. The value returned for this bit depends on the current write density of the DLT2000 as follows:

0 - Data compression is disabled.

1 - Data compression is enabled.

DCC (Data Compression Capable)

The Data Compression Capable bit indicates whether the device supports data compression as follows:

0 - The device does not support data compression

1 - The device supports data compression and will process any data sent to it by the initiator according to the setting of the DCE bit (byte 02, bit 7)

The DLT2000 supports data compression in its native mode, so the value returned for this bit is 1.

DDE (Data Decompression Enable)

The Data Decompression Enable bit indicates whether data decompression is enabled or disabled as follows:

0 - Data decompression is disabled.

1 - Data decompression is enabled.

When the DLT2000 reads compressed data from tape, it automatically decompresses the data before sending it to the initiator. Therefore, the value returned for this bit is always 1 (data decompression enabled).

RED (Report Exception on Decompression)

The DLT2000 does not report exceptions on decompression (boundaries between compressed and uncompressed data). The value returned for the RED field is 00h.

Compression Algorithm

The value returned for the Compression Algorithm field is 10h. This indicates Lempel-Ziv (DLZ) high efficiency data compression algorithm.

Decompression Algorithm

The value returned for the Decompression Algorithm field is 10h. This indicates Lempel-Ziv (DLZ) high efficiency data decompression algorithm. If EEROM parameter EnaRepDCcomp is set, zero value will be reported if the last block read is not decompressed.

8.4.10.6 Disconnect/Reconnect Page (02h)

The drive will support the Disconnect/Reconnect Page which has the following format:

Byte \ Bit	7	6	5	4	3	2	1	0
0	PS	0	Page Code(02h)					
1	Additional Page Length (0Eh)							
2	Buffer Full Ratio							
3	Buffer empty Ratio							
4	(MSB) Bus Inactivity Limit							
5	Bus Inactivity Limit (LSB)							
6	(MSB) Disconnect time Limit							
7	Disconnect time Limit (LSB)							
8	(MSB) Connect Time Limit							
9	Connect Time Limit (LSB)							
10	(MSB) Maximum Burst Size							
11	Maximum Burst Size (LSB)							
12	Reserved						DTDC	
13	Reserved							
14	Reserved							
15	Reserved							

Figure 8-53 *Disconnect/Reconnect Page Format*

The following parameters in this page are supported:

Maximum Burst Size

This value specifies the maximum amount of data that will be transferred without disconnecting. A value of zero sets no limit. This value is in units of 512 bytes. For example, a value of 8 means 4K bytes. Values that are not multiples of 8 are rounded up to the closest multiple of 8.

Data Transfer Disconnect Control (DTDC)

This value specifies the restriction when a disconnect is permitted.

8.4.10.7 Medium Partition Page (11h)

The drive supports the Medium Partitions Parameter Page, which has the following format:

Byte \ Bit	7	6	5	4	3	2	1	0
0	PS	0	PageCode(11h)					
1	Additional Page Length (06)							
2	Maximum Additional Partitions							
3	Additional Partitions Defined							
4	FDP	SDP	IDP	PSUM		Reserved		
5	Medium Format Recognition (01)							
6	Reserved							
7	Reserved							

Figure 8-54 *Medium Partition Page Format*

Maximum Additional Partitions

No additional partitions are supported; this field will be zero.

Additional Partitions Defined

The field specifies the number of additional partitions to be defined for the tape based on the settings of the SDP and IDP bits. The maximum allowed is the value returned in the Maximum Additional Partitions field. Since only one partition is supported, this field will be zero.

Option Flags

FDP–The Fixed Data Partitions bit will be zero.

SDP–The Select Data Partitions bit will be zero.

IDP–The Initiator Defined Partitions bit will be zero.

PSUM–The Partition Size Unit of Measure field will be zero.

Medium Format Recognition

This field is set to 01h indicating that automatic Format Recognition is supported.

8.4.10.8 Read/Write Error Recovery Page (01h)

The drive will support the Error Recovery Page, which has the following format:

Byte \ Bit	7	6	5	4	3	2	1	0
0	PS	0	Page Code(01h)					
1	Additional Page Length (0Ah)							
2	rsvd	rsvd	TB	rsvd	EER	PER	DTE	DCR
3	Read Retry Count							
4	Reserved							
5	Reserved							
6	Reserved							
7	Reserved							
8	Write Retry Count							
9	Reserved							
10	Reserved							
11	Reserved							

Figure 8-55 *Error Recovery Page Format*

Option Flags

- TB–The Transfer Block (when not fully recovered) function is not supported.
- EER–The Enable Early Recovery function is always enabled.
- PER–The Post Error bit turns on reporting of Check Condition to report recovered read/write errors. The default setting of this bit is off.
- DTE–The Disable Transfer on Error feature is not supported so this bit will be zero.
- DCR–The Disable ECC Correction bit feature is not supported so this bit will be zero.

Read Retry Count

This field reports the maximum number of rereads that are done before declaring an unrecoverable error.

Write Retry Count

This field reports the maximum number of overwrite retries that will be performed before declaring an unrecoverable error.

8.4.10.9 EEROM Vendor Unique Page (3Eh)

The drive supports the EEROM vendor unique page (3Eh). All the EEROM parameters that are settable through MODE SELECT EEROM vendor unique page are returned.

Note

Because of the long list of parameters, use MODE SENSE (10) instead of MODE SENSE (6) to retrieve EEROM parameters

Because of the length of the EEROM parameter, a 10-byte MODE SENSE command is required to retrieve the parameters. If a 6-byte MODE SENSE command is used to retrieve the EEROM parameter page, the data returned is as follows:

"Send a 10-byte MODE SENSE command to get the Parameter List."

The data returned by the 10-byte MODE SENSE command for the EEROM page is in the form of a MODE SENSE (10) data header followed by block and page descriptors.

The data in the page descriptor is organized in the form of a parameter header followed by the actual parameters value. The parameter header is as follows:

```
"Name T   Current   Default   Minimum    Maximum
 --------  --------  --------  -----------  -----------"
```

Name refers to the parameter name, for example, PRODUCTID or DEFFAULTCOMPON.

T designates data type: 'b' specifies binary type, 'A' specifies string type, and it is decimal data type if not specified.

Current/Default/ Minimum/Maximum specifies the current/default/minimum/maximum value of the parameter.

8.4.11 PREVENT/ALLOW MEDIUM REMOVAL (1Eh)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (1Eh)							
1	Logical Unit Number			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							Prevent
5	Unused		Reserved				Flag	Link

Figure 8-56 *PREVENT/ALLOW MEDIUM REMOVAL CDB*

This command enables or disables the unloading of the tape cartridge.

Prevent

If this bit is set, the Unload button on the drive front panel is effectively disabled, and the UNLOAD command will not unload the media or the cartridge. The Prevent/Allow status in the device is maintained separately for each initiator.

When the Prevent bit is set to zero, then the Prevent state corresponding to that initiator is cleared. Only when all initiators have cleared their Prevent state are the Unload button and Unload commands enabled again. By default after power up, hard reset, or Bus Device Reset message, the Prevent Medium Removal function is cleared.

If a Media Loader is present, the Move Medium command will not be allowed to remove a cartridge if PREVENT has been selected.

8.4.12 READ (08h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (08h)							
1	Logical Unit Number			Reserved			SILI	Fixed
2	(MSB)							
3	Transfer Length							
4								(LSB)
5	Unused		Reserved				Flag	Link

Figure 8-57 *READ CDB*

READ transfers one or more data blocks to the initiator starting with the next block on the drive.

Fixed

This bit specifies the meaning of the Transfer Length field and whether fixed-length or variable-length blocks are to be transferred.

If the Fixed bit is set to zero, a Variable Block mode is requested. A single block is transferred with the Transfer Length specifying the maximum number of bytes the initiator has allocated for the returned data.

If the Fixed bit is set to one, the Transfer Length specifies the number of blocks to be transferred to the initiator. This is valid only if the logical unit is currently operating in Fixed Block mode.

When the Transfer Length is zero, no data is transferred and the current position on the logical unit is not changed.

A successful READ with the Fixed bit set to one transfers (current block length)×(Transfer Length) bytes of data to the host. Upon termination of READ, the media is logically positioned after the last block transferred (EOM side).

Suppress Incorrect Length Indicator (SILI)

If the SILI bit is one and the fixed bit is one, the target shall terminate the command with CHECK CONDITION status and the sense key shall be set to ILLEGAL REQUEST with an additional sense code of INVALID FIELD in CDB.

If the SILI bit is not set and the actual block length is different from the specified transfer length, a CHECK CONDITION status is returned. Within the Sense data, the

Incorrect Length Indicator (ILI) bit and Valid bit will be set to one. The Sense Key field will be set to NO SENSE. The Information Bytes will be set to the difference (residue) between the requested transfer length and the actual block length, or in Fixed Blocked Mode, the difference (residue) between the requested number of blocks and the actual number of blocks read. No more than transfer length bytes are transferred to the initiator and the tape is logically positioned after the block (EOM side).

If the drive reads a Filemark, it will return a CHECK CONDITION status. Within the Sense data, the Filemark and Valid bits are set and the Sense Key field is set to NO SENSE. The Information fields contain the residue count. The Additional Sense Code and Additional Sense Code Qualifier fields are set to Filemark Detected. Upon termination, the media will be logically positioned after the Filemark (EOM side).

If the drive detects EOD during the READ, the drive will return a CHECK CONDITION status. Within the Sense data, the Valid bit is set and the Sense Key field is set to BLANK CHECK. The EOM bit may be set if the drive determines that the tape is positioned past the PSEN marker. The information fields contain the residue count. The Additional Sense Code and Additional Sense Code Qualifier fields are set. Upon termination, the media will be physically positioned before EOD and after the last block on tape.

The meaning of EOM is different for a read than for a write type of command. EOM is only reported when the physical EOM/P is encountered. The drive returns a CHECK CONDITION status. The EOM and Valid bits are set and the Sense Key is set to MEDIUM ERROR. The information fields contain the residue count and the Additional Sense Code and Additional Sense Code Qualifier fields are set to EOM/P Detected. The tape is physically positioned at EOM/P.

If any READ command cannot be completed successfully the drive returns a CHECK CONDITION status. Further commands should attempt to move past the error and complete successfully.

8.4.13 READ BLOCK LIMITS (05h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (05h)							
1	Logical Unit Number			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 8-58 *READ BLOCK LIMITS CDB*

READ BLOCK LIMITS tells the drive to return its limits for block length. The READ BLOCK LIMITS data shown below is sent during the DATA IN phase of the command. The command does not reflect the currently selected block size, only the available limits. MODE SENSE returns the current block size.

Byte \ Bit	7	6	5	4	3	2	1	0
0	Reserved							
1	(MSB)							
2	Maximum block length							
3								(LSB)
4 5	(MSB) Minimum block length (0001h)							(LSB)

Figure 8-59 *READ BLOCK LIMITS Data*

Maximum Block Length

This field indicates the maximum block size. The device supports a maximum block length of 16,777,215 bytes (16 MB-1) for the 10 GB format. A maximum block length of 256 K bytes is supported for 2.6 GB or 6.0 GB formats.

Minimum Block Size

This field indicates the minimum block size. The device supports a minimum block length of 1 byte.

8.4.14 READ BUFFER (3Ch)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (3Ch)							
1	Logical Unit Number			Reserved			Mode	
2	Buffer ID							
3	(MSB)							
4	Buffer Offset							
5								(LSB)
6	(MSB)							
7	Allocation Length							
8								(LSB)
9	Unused		Reserved				Flag	Link

Figure 8-60 *READ BUFFER CDB*

READ BUFFER is used in conjunction with WRITE BUFFER as a diagnostic function for testing the drive's data buffer and the SCSI bus integrity.

Mode

The drive supports the following values within the field. If any nonsupported value is set, the drive terminates the command with a CHECK CONDITION status and an ILLEGAL REQUEST sense key set.

Mode	Description
000b	Combined Header and Data
010b	Data
011b	Descriptor

Figure 8-61 *READ BUFFER Modes Supported*

Buffer ID & Offset

The drive only supports a single Buffer ID field of zero, and offsetting of data is not supported. If these fields are nonzero, the drive returns a CHECK CONDITION status with an ILLEGAL REQUEST sense key set.

Allocation Length

The Allocation Length specifies the maximum number of bytes that the initiator has allocated for returned data.

8.4.14.1 Combined Header and Data Mode

In this mode, the drive returns a 4-byte header followed by the data bytes. The drive terminates the DATA IN phase when Allocation Length bytes of header and data have been transferred, or when all available data has been transferred to the initiator, whichever is less. The 4-byte READ BUFFER header is followed by data bytes from the target data buffer. The header has the following format:

Byte \ Bit	7	6	5	4	3	2	1	0
0	Reserved							
1	(MSB)							
2	Available Length							
3								(LSB)

Figure 8-62 *READ BUFFER Data Head*

Available Length

The Available Length field specifies the total number of data bytes available in the target's buffer. This number is not reduced to reflect the allocation length, nor is it reduced to reflect the actual number of bytes written using the WRITE BUFFER command. Following the READ BUFFER header, the target will transfer data from its data buffer.

8.4.14.2 Data Mode

In this mode, the DATA IN phase only contains buffer data.

8.4.14.3 Descriptor Mode

In this mode, a maximum of four bytes of READ BUFFER descriptor information are returned. The drive returns the descriptor information for the buffer specified by the Buffer ID. In this mode, the drive does not reject the valid Buffer IDs with a CHECK CONDITION status, but returns all zeros in the READ BUFFER descriptor.

The Offset Boundary is 12 (0Ch), indicating buffer offsets should be integral multiples of 4K.

Byte \ Bit	7	6	5	4	3	2	1	0
0	Offset Boundary (0Ch)							
1	(MSB)							
2	Buffer Capacity							
3								
4								(LSB)

Figure 8-63 *READ BUFFER Descriptor*

8.4.15 READ POSITION (34h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (34h)							
1	Logical Unit Number			Reserved				BT
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Reserved							
8	Reserved							
9	Unused		Reserved				Flag	Link

Figure 8-64 *READ POSITION CDB*

The READ POSITION command is used to read a position identifier, or SCSI Logical Block Address. The LOCATE command uses this identifier to position back to this same logical position, in a high performance fashion.

BT

The Block Type bit indicates how the position is interpreted. Since this device uses the same logical block address whether this bit is set or not, the setting of BT is ignored. The logical block address values include all recorded objects: blocks and filemarks.

Note

The drive returns CHECK CONDITION with the Unit Not Ready Sense Key with the Read Position command if the media is not ready to be accessed.

8.4.15.1 READ POSITION Data Format

Byte \ Bit	7	6	5	4	3	2	1	0
0	BOP	EOP	Reserved			BPU	Reserved	
1	Partition Number							
2 3	Reserved							
4	(MSB)							
5	First Block Location							
6								
7								(LSB)
8	(MSB)							
9	Last Block Location							
10								
11								(LSB)
12	Reserved							
13	(MSB)							
14	Number of Blocks in Buffer							
15								(LSB)
16	(MSB)							
17	Number of Bytes in Buffer							
18								
19								(LSB)

Figure 8-65 *READ POSITION Data Format*

The BOP and EOP bits will be set as appropriate. The Block Position Unknown (BPU) bit is never set since the setting of the BT bit in the Read Position CDB does not affect the block address values returned.

First Block Location

The block address associated with the current logical position; the next block to be transferred between the target and initiator if a READ or WRITE command is issued.

Last Block Location

The block address associated with the current physical position; the next block to be transferred to the media and from the target's buffer. If the buffer is empty, or has only a partial block, the same value as First Block Location will be reported. The first block or filemark written onto the media is at address zero.

Number of Blocks in Buffer

The number of data blocks in the target's buffer.

Number of Bytes in Buffer

The number of data bytes in the buffer that have not been written to the medium.

8.4.16 RECEIVE DIAGNOSTICS RESULTS (1Ch)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (1Ch)							
1	Logical Unit Number			Reserved				
2	Reserved							
3	(MSB) Allocation Length							
4								(LSB)
5	Unused		Reserved				Flag	Link

Figure 8-66 *RECEIVE DIAGNOSTICS RESULTS CDB*

RECEIVE DIAGNOSTIC RESULTS tells the drive to send analysis data to the initiator after completion of a SEND DIAGNOSTIC command. The following data will be returned by this command. A REQUEST SENSE command should be issued to obtain more detailed information following a check condition on a SEND DIAGNOSTIC command.

Byte \ Bit	7	6	5	4	3	2	1	0
0	Controller Present flag							
1	Controller Error flag							
2	Drive Present flag							
3	Drive Error flag							
4	Media Loader Present flag							
5	Media Loader Error flag							

Figure 8-67 *Receive Diagnostic Result Data Format*

This information simply indicates which of the main components of the subsystem has failed testing.

8.4.17 RELEASE UNIT (17h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (17h)							
1	Logical Unit Number			3rdPty	Third Party Device ID			Rsvd
2	Reserved							
3	Reserved							
4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 8-68 *RELEASE UNIT CDB*

RELEASE UNIT releases the drive if it is currently reserved by the requesting initiator.

It is not an error to attempt to release the drive if it is not currently reserved by the requesting initiator. However, if it reserved by another initiator, the drive is not released.

3rdPty

The third-party release option for RELEASE UNIT allows an initiator to release a logical unit that was previously reserved using the third-party reservation option. If the third-party (3rdPty) bit is zero, then the third-party release option is not requested. If the 3rdPty bit is one, the drive is released if it was originally reserved by the same initiator using the third-party reservation option, and if the device is the same SCSI device that was specified in the third-party device ID field.

8.4.17.1 Medium Changer Considerations

The optional Element reservation feature defined for Medium Changer devices in SCSI-2 is not supported, so the RELEASE command is defined the same as for the tape drive: Only the whole loader unit can be released. Reserve/release of the Loader and Drive LUNs are handled independently.

8.4.18 REQUEST SENSE (03h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (03h)							
1	Logical Unit Number			Reserved				
2	Reserved							
3	Reserved							
4	Allocation Length							
5	Unused		Reserved				Flag	Link

Figure 8-69 *REQUEST SENSE CDB*

REQUEST SENSE tells the target to transfer sense data to the initiator.

The sense data is valid for a CHECK CONDITION or RESERVATION CONFLICT status returned on the previous command. The sense data bytes are preserved by the target until retrieved by the REQUEST SENSE command, or until the receipt of any other command from the same initiator.

If the drive receives an unsolicited REQUEST SENSE, then it returns Sense Data with the appropriate values in the EOM, Sense Key, Additional Sense Code, and Additional Sense Code Qualifier. The positional information provided reflects the logical position of the drive. The drive returns information based on the (nondiagnostic) data still in its buffer as well as the data on tape.

REQUEST SENSE does not cause the drive to flush its buffered data to tape. Therefore, if the host requires the exact physical positioning of the media, it should precede the REQUEST SENSE with a WRITE FILEMARKS with length 0 (Immed =0) command, which forces the drive to flush any currently buffered data to tape. A subsequent REQUEST SENSE will return the actual physical (and logical) position of the drive to the initiator.

Allocation Length

The Allocation Length specifies the maximum number of sense bytes to be returned. The drive terminates the transfer when Allocation Length bytes have been transferred or when all available sense data has been transferred to the host, whichever is less.

8.4.18.1 Sense Information Format

Byte	Bit 7	6	5	4	3	2	1	0
0	Valid	Error Code						
1	Segment Number							
2	Filemark	EOM	ILI	Reserved	Sense Key			
3	(MSB)							
4								
5	Information Bytes							
6								(LSB)
7	Additional Sense Length							
8	(MSB)							
9								
10	Command Specific Information Bytes							
11								(LSB)
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	Sub-Assembly Code							
15	SKSV	C/D	Reserved		BPV			
16	(MSB)							
17	Field Pointer							(LSB)
18	Internal Status Code (VU)							
19	(MSB)							
20	Tape Motion Hours							(LSB)
21	(MSB)							
22								
23	Power On Hours							
24								(LSB)

Figure 8-70 *REQUEST SENSE Data*

Byte	7	6	5	4	3	2	1	0
25	(MSB)							
26								
27				Tape Remaining				
28								(LSB)

Figure 8-70 *REQUEST SENSE Data Cont'd*

Valid

A Valid bit of one indicates that the information bytes contain valid information as defined in the SCSI specification.

Error-Code

A value of 70h indicates a current error – the report is associated with the most recently received command.

A value of 71h indicates a deferred error – the report is associated with a previous command and not as a result of the current command.

No other values will be returned.

Segment Number

This byte is always zero.

Filemark

This bit indicates that the current command has read a Filemark.

EOM

This bit indicates that an End-of Medium condition (End of Partition or Beginning of Partition) exists. The warning is also given by setting the Sense Key to NO SENSE and the Additional Sense Code Qualifier to End of Partition or Beginning of Partition.

For write-type operations, the drive returns a CHECK CONDITION on any operation which occurs after detection of the Early Warning EOP marker. The EOM and Additional Sense Code fields will be set. For read-type operations, the drive does not return a CHECK CONDITION until the drive encounters the physical EOP.

ILI

The Incorrect Length Indicator bit indicates that the requested logical block length did not match the logical block length of the data on the tape. Only Read or Verify may cause this bit to be set.

Sense Key

In most cases, Additional Sense Code and/or Qualifier information is available. See the tables later in this section.

Information Bytes

These bytes contain the differences (residue) of the requested length minus the actual length in bytes, blocks, or Filemarks, as determined by the command. Negative values are indicated by two's complement notation. The bytes are valid for all read, write, space, and verify tape commands for which a CHECK CONDITION status has been generated. The information bytes are zero for MODE SELECT/SENSE, INQUIRY, READ BLOCK LIMITS, and TEST UNIT READY.

Additional Sense Length

This specifies the number of additional sense bytes to follow. If the Allocation Length of the command descriptor block is too small to transfer all of the additional sense bytes, the Additional Sense Length is not adjusted to reflect the truncation.

Command Specific Information Bytes

Command Specific Bytes are handled as device specific and can be logged by the operating system on error conditions. On media errors, this usually contains the current SCSI Logical Block Address.

Additional Sense Code (ASC) and ASC Qualifier

These two bytes provide additional information about the Sense Key and cause of the CHECK CONDITION status. See the tables later in this section.

Sub-Assembly Code

Unused at present, returned as 0.

Field Pointer Bytes

C/D - When set, indicates that the illegal parameter is in the CDB. A C/D of zero indicates that the illegal parameter is in the Parameter List from the initiator.

BPV - When the Bit Pointer Valid bit is set, it indicates that the Bit Pointer field is valid and designates which bit of the byte designated by the field pointer is in error. For a multi-bit field, it points to the most significant bit of the field.

Field Pointer - Indicates which byte of the CDB or Parameter List was in error. For a multi-byte field, the most significant byte is indicated.

Internal Status Code

For a complete definition of Internal Status Code, see Appendix B.

Tape Motion Hours

Report the number of tape motion hours, that is, the head wear hours. Format is represented in a hex decimal word (2 bytes).

Power On Hours

Report the total hours the drive power has been on. Format is represented in a hex decimal longword (4 bytes).

Tape Remaining

Report the amount of tape remained in 4096 bytes block.

Table 8-5 *Sense Keys Used*

Sense Key	Description
0h	No Sense. Check the Filemark/EOM/ILI bits and the ASC/Q bytes.
1h	Recovered Error. This can be caused by rounding of Mode Parameters on a Mode Select, or to report that R/W error rates are reaching subsystem specification limits for optimal operation. However, the device may still be able to continue to function without any unrecovered errors for a long period of time.
2h	Not Ready. The media is not ready for tape operation commands. Media might not be present in the drive, or may be in the process of loading or calibrating.
3h	Medium Error. An unrecoverable write, read, or positioning error has occurred. Detailed device specific information may be available.
4h	Hardware Error. The Additional Sense Code/Qualifier fields may provide more specific information.
5h	Illegal Request. The CDB or supplied parameter data had an unsupported or illegal operation specified. Check bytes 15, 16, and 17.
6h	Unit Attention. Unit Attentions are created after a device reset, if the media asynchronously becomes ready to this initiator, if another initiator changes Mode Parameters, and if the firmware is updated.
7h	Data Protected. The current media is write-protected. This can be because of the Write Protect switch on the cartridge, or if the media is not CompacTape III.
8h	Blank Check. An EOD or LongGap has been encountered.
Bh	Command Aborted. Generated when a command has been aborted by the tape device for some reason. Check the ASC/Q bytes.
Dh	Volume Overflow. Physical end of media has been reached during writing. The initiator ignored the EOM condition and continued writing.
Eh	Miscompare. A compare error occurred during reading by the self-tests invoked during execution of a Send Diagnostic.

Table 8-6 *Additional Sense Codes/Qualifiers Used*

ASC	ASCQ	Description
00h		No Additional Sense Code
	00h	No additional sense qualifier
	01h	Unexpected FM Encountered
	02h	End of Medium Encountered
	03h	SetMark Encountered
	04h	Beginning of Medium Encountered
	05h	EOD Encountered
04h		Unit not ready
	00h	Cause nonreportable
	01h	Calibration in process
	02h	Load command needed
	03h	Manual Intervention needed
08h	00h	LUN Communications Failure
	01h	LUN Communications Timeout
0Ah	00h	Error Log Overflow
0Ch	00h	Write Error
11h	00h	Unrecovered Read Error
	08h	Incomplete Block Read
14h	00h	Recorded Entity Not Found
15h	01h	Mech Position Error
	02h	Detected by Read of Media
1Ah	00h	Parameter List Length Error

Table 8-6 *Additional Sense Codes/Qualifiers Used (Cont'd)*

ASC	ASCQ	Description
20h	00h	Illegal opcode
21h	01h*	Invalid Element Address
24h	00h	Invalid CDB field
	81h	Invalid mode on write buffer
	82h	Media in drive
	84h	Insufficient resources
	86h	Invalid offset
	87h	Invalid size
	89h	Image data over limit
	8Bh	Image/personality is bad
	8Ch	Not immediate command
	8Dh	Bad drive/servo image EDC
	8Eh	Invalid personality for CUP
	8Fh	Bad controller image EDC
25h	00h	Illegal LUN
26h		Parameter list error
	00h	Invalid Field
	01h	Parameter not supported
	02h	Parameter Value Invalid
27h	00h	Write protected
	80h	Hardware write protect
	82h	Data safety write protect
28h	00h	Not ready to read
29h	00h	Reset occurred
2Ah	01h	Mode parameters changed
	02h	Log parameters changed

Table 8-6 *Additional Sense Codes/Qualifiers Used (Cont'd)*

ASC	ASCQ	Description
2Fh	00h	Commands Cleared by another Initiator
30h	00h	Cannot read medium
37h	00h	Rounded Parameter
39h	00h	Saving Parameters Not Supported
3Ah	00h	Media Not Present
	80h	VU Cartridge Missing
3Bh	00h	Sequential Positioning Error
	08h	Reposition Error
	0Dh*	Media Destination Element Full
	0Eh*	Media Source Element Empty
3Dh	00h	Invalid Bits in ID Msg
3Fh	01h	Microcode has been changed
40h	80h	ROM EDC failure
	81h	RAM failure
	82h	Bad Drive status
	83h	Loader diags failed
	84h	Reportable POST failure
43h	00h	Message error

Table 8-6 *Additional Sense Codes/Qualifiers Used (Cont'd)*

ASC	ASCQ	Description
44h	00h	Internal Target Failure
	80h	Unexpected Selection Interrupt
	82h	Command complete sequence failure
	83h	SCSI chip Gross Error
	84h	Unexplained Residue in TC Registers
	85h	Immediate data transfer timeout
	86h	Insufficient CDB bytes
	87h	Disconnect/SDP sequence failed
	88h	Bus DMA Transfer Timeout
	C1h	EEPROM copy 1 area bad
	C2h	EEPROM copy 2 area bad
	C3h	Both EEPROM copies bad
45h	00h	Select/Reselect Failure
47h	00h	SCSI Parity Error
48h	00h	IDE Message received
49h	00h	Invalid Message Error
4Eh	00h	Overlapped Commands attempted
51h	00h	Erase failure
53h	00h	Media Load/Eject failure
	01h	Unload Tape failure
	02h	Media Removal Prevented
5Ah	01h	Operator Media Removal Request

Table 8-6 *Additional Sense Codes/Qualifiers Used (Cont’d)*

ASC	ASCQ	Description
5Bh	01h	Threshold Condition Met
	02h	Log Counter at Maximum
80h	00h	Calibration Error
	01h	Cleaning Required
	02h	Cleaning Requested
81h	00h	Directory Read Error
82h	00h	Not allowed if not at BOT

* = Medium Changer specific commands

8.4.19 RESERVE UNIT (16h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (16h)							
1	Logical Unit Number			3rdPty	Third-Party Device ID			RsvdD
2	Reserved							
3	Reserved							
4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 8-71 *RESERVE UNIT CDB*

RESERVE UNIT reserves the specified drive for exclusive use by the requesting initiator or for another specified SCSI device. The reservation remains in effect until one of the following conditions is met:

- The initiator that made the reservation sends another RESERVE UNIT command.
- The drive is released by RELEASE UNIT from the same initiator.
- A BUS DEVICE RESET message is received from any initiator.
- A hard reset occurs.

The occurrence of the last two conditions is indicated by the drive returning a CHECK CONDITION status with a sense key of UNIT ATTENTION on the next command following the condition. It is not an error to issue RESERVE UNIT to a drive that is currently reserved to the requesting initiator.

If the logical unit has previously been reserved by another initiator, the target returns a RESERVATION CONFLICT status.

If, after honoring the reservation, any other initiator attempts to perform any command except INQUIRY, REQUEST SENSE, or RELEASE UNIT, the command is rejected with a RESERVATION CONFLICT status. A RELEASE UNIT command issued by another initiator is ignored by that reserved logical unit.

3rdPty

The third-party reservation option for RESERVE UNIT allows an initiator to reserve a logical unit for another SCSI device. This option is intended for systems that use COPY, and is implemented by the drive.

If the third-party (3rdPty) bit is zero, then the third-party reservation option is not requested. If the 3rdPty bit is one, RESERVE UNIT reserves the logical unit for the

SCSI device specified in the Third-Party Device ID field. The drive preserves the reservation until any one of the four conditions mentioned above occurs. The drive ignores any attempt made by any other initiator to release the reservation and returns a GOOD status.

An initiator that holds a current reservation may modify that reservation (for example, to switch third-parties) by issuing another RESERVE UNIT to the drive.

8.4.19.1 Medium Changer Considerations

The optional Element reservation feature defined for Medium Changer devices in SCSI-2 is not supported, so the RESERVE command is defined the same as for the tape drive: Only the whole loader unit can be reserved. This is separate from a reservation of the tape drive.

The RESERVE/RELEASE commands operate on a LUN basis; so the Medium Changer and Tape Drive are generally handled as different devices. But in the case of a reserved drive LUN, a MOVE MEDIUM command issued to the loader LUN can not insert/remove a cartridge on the drive, unless the drive is reserved by the same initiator.

8.4.20 REWIND (01h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (01h)							
1	Logical Unit Number			Reserved				Immed
2	Reserved							
3	Reserved							
4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 8-72 *REWIND CDB*

REWIND tells the drive to position the tape at the beginning of the currently active partition. Before rewinding, the drive writes any write data that is buffered to the tape, and appends an EOD marker.

Immed

If the Immed (Immediate) bit is set, the drive first writes any remaining buffered data to tape followed by an EOD marker. It then returns status to the host before beginning the actual rewind operation. If the Immed bit is not set, status will be returned after the rewind has completed.

8.4.21 SEND DIAGNOSTIC (1Dh)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (1Dh)							
1	Logical Unit Number			PF	Rsv'd	Selftst	Dev OfL	UnitOfL
2	Reserved							
3	(MSB) Parameter List Length							
4	Parameter List Length (LSB)							
5	Unused		Reserved				Flag	Link

Figure 8-73 *SEND DIAGNOSTIC CDB*

SEND DIAGNOSTIC tells the drive to perform diagnostic tests on itself.

The Page Format field is not supported and must be zero.

Two separate types of unit resident tests can be accessed:

- Electronics Self-Test - (Level 1 test) To invoke the diagnostic, a good portion of the controller hardware and software must be functioning properly. This is the premise this test is based on: that full power-up testing is not necessary. Therefore, this test does an extension of the power-up self tests. The code ROM EDC is verified, two queues used by much of the controller software is checked by dequeuing and enqueuing items.

  If there is a loader attached, a software reset is done on it. This test does not attempt to write or read data to or from media. When complete, any errors are posted in the extended Sense Data bytes. This test has an execution time of approximately 5 seconds.

  This test is specified by setting just the Self-Test bit (DevOfL, and UnitOfL both zero).

- Write/Read Functionality Test - (Level 2 test). The default version of this test does the following:
  - Writes 100 32 KB records on track 0.
  - Rewinds the tape.
  - Reads the records.
  - Positions to the beginning of track 1.

- Writes 100 32 KB records on track 1.
- Repositions to the beginning of track 1.
- Reads the records.
- Rewinds the tape. The execution time for the test is 6 minutes, if calibration is not required. This test is specified by setting the Self-Test and UnitOfL bits, and zeroing the DevOfL bit. This test can accept a parameter list specifying test variables, as shown in the next table.

  If a parameter list is specified, all parameters must be filled in and the parameter list length should be set to 12. If these requirements are not met, an ILLEGAL REQUEST will be returned. The Self-Test bit should be zero.

Table 8-7 *Send Diagnostics Parameters*

Selftest	DevOfL	UnitOfL	Selftest Action
0	0	0	Illegal combination
0	0	1	Self-Test 2 with default parameters
0	1	0	Illegal combination
0	1	1	Self-Test 2 with default parameters
1	0	0	Self-Test 1 with default parameters
1	0	1	Self-Test 2 with default parameters
1	1	0	Self-Test 1 with default parameters
1	1	1	Self-Test 2 with default parameters

Byte \ Bit	7	6	5	4	3	2	1	0
0	(MSB)			Pattern Number				
1								(LSB)
2	(MSB)			Maximum Number of Test Passes				
3								(LSB)
4	(MSB)							
5				Block Size				
6								
7								(LSB)
8	(MSB)							
9				Block Count				
10								
11								(LSB)

Figure 8-74 *SEND DIAGNOSTIC Parameter List Format*

Table 8-8 *Definition of Pattern Numbers*

Pattern	Name	Data in Hex
0	Rotate	(Rotate through the other 9 patterns, change for each tape file)
1	All 0's	00 00 00 00 00
2	2F	FF FF FF FF FF
3	Alternating 1's and 0's	55 5A AA A5 55 5A AA A5
4	Marching 1	01 02 04 08 10 20 40 80
5	Marching 0	FE FD FB F7 EF DF BF 7F
6	MW	0E 0E 0E 0E 0E 0E 0E 0E
7	MFM	DE AD DE AD DE AD DE AD
8	1F	AA AA AA AA AA AA AA AA
9	Random Data	

If the Max Number of Passes is zero, this indicates to loop forever. A BUS Reset or a selection from the host sending an Abort or a Bus Device Reset message will terminate testing.

If the Block Size field is set to zero, random block sizes will be used.

The Block Count field specifies how many blocks to write/read starting first on track 0, then again on track 1. So if the Block Size and Count fields result in 3 tracks worth of data, the test will:

- Write tracks 0, 1, 2
- Rewind, read, and verify 0, 1, 2
- Write 3 tracks starting with 1: 1, 2, 3 and then rewind to the beginning of track 1 and do the read/verify pass. If Block Count is set to zero, data will be written until EOT is reached each time, so almost 4 complete passes over the tape would result.

Note

Because of data generation and verification, this test only streams the tape for short periods of time. Therefore, if Block Count is set very high, this test can take many minutes or even many hours to complete.

If the specified test passes, a GOOD STATUS is returned. Otherwise, a Check Condition is generated, and the Sense Data will contain information about the failure.

Table 8-9 *Sense Keys Used*

Sense Key	Description
3h	Medium Error. A positioning error has occurred where the returned position does not match the expected.
4h	Hardware Error. The Additional Sense Code/Qualifier fields will provide more specific information.
5h	ILLEGAL REQUEST. Illegal bit settings in the SEND DIAGNOSTIC command.
Eh	Miscompare. A compare error occurred during a read.

Table 8-10 *Additional Sense Codes*

Additional Sense Code	Additional Sense Qualifier	Description
15h	2h	A positioning error has occurred where the returned position does not match the expected.
40h	80h	Level 1 ROM test failed.
40h	81h	Level 1 RAM test failed.
40h	82h	Level 1 test failed. Bad Drive status.
40h	83h	Level 1 test failed. Loader Reset failed.

8.4.22 SPACE (11h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (11h)							
1	Logical Unit Number			Reserved		Code		
2	(MSB)							
3	Count							
4								(LSB)
5	Unused		Reserved				Flag	Link

Figure 8-75 *SPACE CDB*

SPACE provides a variety of positioning functions that are determined by Code and Count fields in the Command Descriptor Block. Both forward (toward EOM/P) and reverse (toward BOM/P) positioning are provided.

Code

The code is defined as follows:

Space Code	Space by:
000b	Blocks
001b	Filemarks
010b	Sequential Filemarks
011b	End-of-Data

Figure 8-76 *SPACE Code Definition*

For 2.6 and 6.0 GB format, the drive supports count values 0, 1, and 2 only. For 10.0 GB format, compress or noncompress, the count value can be from 0 to FFFFFFh.

Count

When spacing over blocks or marks, the Count field is interpreted as follows:

- A positive value N causes forward movement over N blocks or marks. The tape is logically positioned after the Nth block or mark on the EOM/P side.
- A zero value causes no change in the logical position.
- A negative value -N (two's complement notation) causes reverse movement over N blocks or marks. The tape is logically positioned on the BOM/P side of the Nth block or mark.
- When spacing to EOD, the Count field is ignored. Forward movement occurs until the drive encounters EOD. The position is such that a subsequent WRITE command would append data after the last object that has been written to tape before EOD.

When executing SPACE, the drive implements the following hierarchy:

Blocks - lowest

Filemarks

EOD

BOM/P or EOM/P - highest

Therefore, SPACE N blocks will halt with GOOD status after the Nth block, or with CHECK CONDITION status on any occurrence of Filemark, EOD, BOM/P, or EOM/P. A space N Filemarks will halt on the Nth Filemark or on any occurrence of EOD, BOM/P, or EOM/P, and so on.

Depending on the size of blocks, read ahead data in the buffer allows some spacing requests to be satisfied without tape movement.

8.4.23 TEST UNIT READY (00h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (00h)							
1	Logical Unit Number			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 8-77 *TEST UNIT READY CDB*

TEST UNIT READY checks if the drive unit is ready for commands involving tape movement. If the drive has a tape loaded, the command returns a GOOD status. Otherwise, CHECK CONDITION is reported.

It is possible to get multiple check conditions on a TEST UNIT READY command because of power cycle, code update, and tape loaded.

8.4.23.1 Medium Changer Considerations

When directed at the Media Loader LUN, this command will return Check Condition, Sense Key, or Not Ready if:

- The Mode Select key switch is in the Service mode, and there is no 24V signal (usually means the loader assembly has been moved out of its sleeve enough to trip the 24V interlock.)

8.4.24 VERIFY (13h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (13h)							
1	Logical Unit Number			Reserved		Immed	BC	Fixed
2	(MSB)							
3	Verification Length							
4								(LSB)
5	Unused		Reserved				Flag	Link

Figure 8-78 *VERIFY CDB*

VERIFY verifies one or more blocks beginning with the next block on the tape. Both CRC and EDCs are validated.

Immed

If this bit is set, the Verify command will complete before any media movement is done (that is, when processing has been initiated).

BC

This bit selects a CRC/ECC verification or a byte-by-byte compare. If the BC bit is cleared, the device is instructed to perform an internal CRC/ECC check of the data.

If this bit is set, the command will be rejected.

Fixed

This bit operates in the same fashion as with the READ command.

8.4.25 WRITE (0Ah)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (0Ah)							
1	Logical Unit Number			Reserved				Fixed
2	(MSB)							
3	Transfer Length							
4								(LSB)
5	Unused		Reserved				Flag	Link

Figure 8-79 *WRITE CDB*

WRITE transfers one or more blocks from the host to the current logical position. When in Buffered Mode (see MODE SELECT), the tape drive reports a GOOD status on WRITE commands as soon as this data block has been transferred to the data buffer.

The drive flushes the write buffer to tape under the following conditions:

- The write hold-off time limit is exceeded. (See MODE SELECT command.)
- Receipt of the following nonwrite commands:

  LOAD-UNLOAD

  REWIND

  ERASE

  LOCATE

  MOVE MEDIUM

  PREVENT/ALLOW MEDIUM REMOVAL that clears a prevent state

- A Write Filemarks command with the immediate bit cleared.
- A SCSI Reset or Bus Device Reset a reset message is received.

If Buffered Mode is not selected, the buffer will flush after every write-type command. Buffered Mode can be configured through MODE SELECT, and if it is not used, the tape drive suffers a significant degradation in performance with respect to transfer rate and therefore, loss of streaming.

Fixed

The fixed bit specifies both the meaning of the Transfer Length field and whether fixed-length or variable-length blocks are to be transferred. If the Fixed bit is set to zero, Variable Block mode is selected. A single block is transferred from the initiator and is written to the logical unit beginning at the current logical tape position. Upon successful termination, the tape is logically positioned after this block (EOM/P side). The Transfer Length specifies the number of bytes that the drive handshakes out from the initiator.

If the Fixed bit is set to one, the Transfer Length field specifies the number of blocks to be transferred to the host beginning at the current tape position. This form of WRITE is valid only if the logical unit is currently operating in Fixed Block mode, in other words, when it has been instructed to use fixed-length blocks with MODE SELECT. The current block length is the block length defined in the MODE SELECT command. Upon termination, the tape is logically positioned after these blocks.

Transfer Length

This field contains the length of the data transfer in bytes or blocks, depending on whether Fixed or Variable block mode is selected.

If the Transfer Length is zero, no data is transferred and the current position on the logical unit is not changed.

Exception Conditions

If EOT is detected while writing, the drive will finish writing any buffered data. The command terminates with CHECK CONDITION status. Within the Sense data, the EOM bit is set, the Sense Key field is set to NO SENSE, and the Additional Sense Code and Additional Sense Code Qualifier fields are set to EOM/P detected. The drive attempts to complete any subsequent writes, returning a CHECK CONDITION status in each case.

If the drive encounters the physical EOM when attempting write, CHECK CONDITION status is returned. Within the Sense data, the EOM and Valid bits are set, and the Sense Key field is set to Volume Overflow The Information fields contain the residue count and the Additional Sense Code and Additional Sense Code Qualifier fields are set to EOM/P Detected. The tape is physically positioned at EOM/P.

8.4.26 WRITE BUFFER (3Bh)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (3Bh)							
1	Logical Unit Number			Reserved		Mode		
2	Buffer ID (00h)							
3	(MSB) Buffer Offset (000000h)							
4								
5	(LSB)							
6	(MSB) Parameter List/Data Length							
7								
8	(LSB)							
9	Unused		Reserved				Flag	Link

Figure 8-80 *WRITE BUFFER CDB*

WRITE BUFFER is used with READ BUFFER as a diagnostic function for testing the device data buffer, DMA engine, SCSI bus interface hardware, and SCSI bus integrity. It is also used for downloading and updating controller microcode (firmware).

Mode

The drive supports the following values within the field. If any other value is set, the drive terminates the command with a CHECK CONDITION status and an ILLEGAL REQUEST sense key set.

Mode	Description
000b	Write combined header and data
010b	Write data
100b	Download Microcode
101b	Download Microcode and Save

Figure 8-81 *WRITE BUFFER Modes Supported*

For all modes, only a Buffer ID of zero is supported. If the Buffer ID field is nonzero, the command will be rejected. The target detects and rejects commands that would overrun the buffer.

8.4.26.1 Header and Data Mode

The data to be transferred is preceded by a 4-byte header consisting entirely of reserved bytes. This header is discarded (not stored into the buffer). The buffer offset field must be zero for this mode.

8.4.26.2 Write Data

Similar to mode 000b, except there is no header in the data passed to the target. The Buffer Offset must be zero. Potential buffer overruns are detected and the command is rejected.

8.4.26.3 Download Microcode

Using buffer offsets, the host can download the firmware image into the target's buffer in pieces. These commands do not cause the new image to become active. A Download and Save mode Write Buffer command must be issued.

The tape drive must be empty to allow downloading of an image. This is to safeguard against accidentally starting a firmware update. If a cartridge is loaded when all or part of a firmware image has been downloaded, another WRITE BUFFER with Download mode will be rejected. Overlapping or nonconsecutive downloading of the image data is not supported. The firmware image must be downloaded in integral multiples of 4K bytes.

Any error on a Write Buffer command causes any downloaded image data to be discarded, and the download must be restarted from the beginning.

8.4.26.4 Download Microcode and Save

This mode can be used to download and save the entire image at once, or to download the image data and save it, or to cause a save operation after all the image data has been downloaded using the Download only mode. This mode of the command causes the image data to be verified and the Flash EEPROM firmware area to be updated. During the reprogramming, the Write Protect and Drive Activity LEDS on the drive's front panel will blink.

Note

During the actual reprogramming of the FLASH memory chips, if any type of powerfail occurs, or if the reprogramming fails part way through, the subsystem will be unusable, and the controller board will need to be replaced.

When the Save operation is successfully completed, the firmware restarts itself, causing POST to be rerun, and two Unit Attention conditions are generated: power-up reset, and operating code has changed.

8.4.27 WRITE FILEMARKS (10h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (10h)							
1	Logical Unit Number			Reserved			WSmk	Immed
2	(MSB)							
3	Number of Filemarks							
4								(LSB)
5	Unused		Reserved				Flag	Link

Figure 8-82 *WRITE FILEMARKS CDB*

WRITE FILEMARKS causes the specified number of Filemarks to be written beginning at the current logical position on tape. If the Immed bit is not set, any data or Filemarks in the write cache buffer are written to tape. Upon a Bus Reset or when a Bus Reset message is received, the cached blocks or filemarks are flushed to the tape.

WSmk

If this bit is set, the tape drive writes a save-set mark to tape instead of a Filemark. Since Setmarks are not supported by the DLT2000, this field must be zero.

Immed

If this bit is set, the drive returns status as soon as the command descriptor block has been validated, unless the filemark count is zero, or greater than 1 (since both cause the write buffer to be flushed to media). An Immed bit of zero indicates the status will not be returned until the operation is complete.

Number of Filemarks

This is the number of consecutive marks to be written to tape. A value of zero is not considered an error and GOOD status is returned.

This command may be used to force the drive to write any buffered write data to the tape. If the drive is in Buffered mode, and WRITE FILEMARKS is received, the requested Filemarks are appended to the data, and the write buffer is flushed to tape. A zero value in the Number of Filemarks field indicates that no Filemarks are to be written to the tape, but still flushes any write data to tape.

If EOT is detected while writing Filemarks, the drive finishes writing any buffered data and terminates with CHECK CONDITION status. Within the Sense data, the EOM bit is set, the Sense Key field is set to NO SENSE and the Additional Sense Code and

Additional Sense Code Qualifier fields are set to EOM/P detected. The drive will attempt to complete any subsequent WRITE FILEMARKS, returning a CHECK CONDITION status in each case. If the drive encounters the physical EOM when attempting a WRITE FILEMARKS, CHECK CONDITION status is returned.

8.5 Supported SCSI-2 Medium Changer Device Commands

On the Medium Changer LUN, only commands defined for this device type are allowed. The following commands are implemented:

Table 8-11 *SCSI-2 Medium Changer Commands*

Opcode	Command	Section
07*	INITIALIZE ELEMENT STATUS	8.5.1
12	INQUIRY	8.4.4
15+	MODE SELECT	8.5.3
1A+	MODE SENSE	8.5.3
A5*	MOVE MEDIUM	8.5.4
3C	READ BUFFER	8.4.14
B8*	READ ELEMENT STATUS	8.5.2
1C	RECEIVE DIAG RESULTS	8.4.16
17	RELEASE	8.4.17
03	REQUEST SENSE	8.4.18
16	RESERVE	8.4.19
1D	SEND DIAGNOSTIC	8.4.21
00	TEST UNIT READY	8.4.23
3B	WRITE BUFFER	8.4.26

* = Medium Changer specific commands

+ = Commands with significant Medium Changer specific content

The Inquiry, Send Diagnostic, Receive Diagnostic Results, Read/Write Buffer, and Request Sense commands are documented in the preceding sections.

The rest of this chapter covers Medium Changer unique commands.

8.5.1 INITIALIZE ELEMENT STATUS (07h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (07h)							
1	Logical Unit Number			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 8-83 *Initialize Element Status CDB*

This command causes the medium changer to initialize the element status.

8.5.2 READ ELEMENT STATUS (B8h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (B8h)							
1	Logical Unit Number			VolTag	Element type Code			
2	(MSB) Starting Element Address							
3								(LSB)
4	(MSB) Number of Elements							
5								(LSB)
6	Reserved							
7	(MSB)							
8	Allocation Length							
9								(LSB)
10	Reserved							
11	Unused		Reserved				Flag	Link

Figure 8-84 *READ ELEMENT STATUS CDB*

Code	Description
0h	All element types reported (valid in CDB only)
1h	Medium Transport Element
2h	Storage Element (magazine slot)
3h	Import Export Element (not supported)
4h	Data Transfer Element (tape drive)
5h−Fh	reserved

Figure 8-85 *Element Type Code Definitions*

The format of Element Status data is defined in the SCSI-2 specification. The following sections show the information returned for the medium changer. The Element Status data is made up of a header, and one or more Status Pages (for each element type). The Status Pages are made up of a header and one or more element descriptors (one for each element address). The data shown assumes the CDB was specified in such a way that all descriptors for a given element type would be returned.

The Primary and Alternate Volume Tag functions are not supported, so the flags indicating these functions in the Element Status Pages (below) are always set to zero.

8.5.2.1 Element Status Data Header

Byte \ Bit	7	6	5	4	3	2	1	0
0	(MSB)	First Element Address Reported						
1								(LSB)
2	(MSB)	Number of Elements Reported						
3								(LSB)
4	Reserved							
5	(MSB)	Byte Count of Report Available						
6								
7								(LSB)

Figure 8-86 *Element Status Data Header*

8.5.2.2 Medium Transport Element Status Page

Byte	7	6	5	4	3	2	1	0
0	Element Type Code (1h = Medium Transport)							
1	PVolTag	AVolTag	Reserved					
2	(MSB)							
3	Transport Element Descriptor Length							(LSB)
4	Reserved							
5	(MSB)							
6	Byte Count of Descriptor Data Available							
7								(LSB)
Descriptor								
8	(MSB)							
9	Transport Element Address (01h)							(LSB)
10	Reserved					Except	Rsv'd	Full
11	Reserved							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	Reserved							
15	Reserved							
16	Reserved							
17	SValid	Invert	Reserved					
18	(MSB)							
19	Source Element Address							(LSB)
20	Reserved							
21	Reserved							
22	Reserved							
23	Reserved							

Figure 8-87 *Medium Transport Element Status Page*

There is only one Medium Transport element, which can be addressed explicitly as element address 1, or implicitly as address 0.

PvolTag and AVolTag are always zero.

8.5.2.3 Storage Element Status Page

Byte	7	6	5	4	3	2	1	0
0	Element Type Code (2h = Medium Transport)							
1	PVolTag	AVolTag	Reserved					
2	(MSB)							
3	Storage Element Descriptor Length							(LSB)
4	Reserved							
5	(MSB)							
6	Byte Count of Descriptor Data Available							
7								(LSB)

Descriptor

Byte	7	6	5	4	3	2	1	0
8	(MSB)							
9	First Storage Element Address Reported							(LSB)
10	Reserved				Access	Except	Rsv'd	Full
11	Reserved							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	Reserved							
15	Reserved							
16	Reserved							
17	SValid	Invert	Reserved					
18	(MSB)							
19	Source Element Address							(LSB)
20	Reserved							
21	Reserved							
22	Reserved							
23	Reserved							
24	Density Code of Media (= 0 if empty) (VU)							
25	Unused (VU)							
26 to n	Descriptors for other Storage Elements							

Figure 8-88 *Storage Element Status Page*

There are up to five/seven Storage Elements, corresponding to the number slots in a magazine for DLT2500/DLT2700.

PvolTag and AVolTag are always zero.

Access is always 1, and Full is set to 1 if a media cartridge is in the corresponding magazine slot. Exception will be set to 1 if the magazine slot indicates a cartridge has been removed, but is not in the Medium Transport or Data Transfer elements.

The Source Element Address will always be set to this element's address.

8.5.2.4 Data Transfer Element Status Page

Byte	7	6	5	4	3	2	1	0
0	Element Type Code (4h = Medium Transport)							
1	PVolTag	AVolTag	Reserved					
2	(MSB)	Data Transfer Element Descriptor						
3								(LSB)
4	Reserved							
5	(MSB)							
6	Byte Count of Descriptor Data Available							
7								(LSB)

Descriptor

Byte	7	6	5	4	3	2	1	0
8	(MSB)	Data Transfer Element Address (10h)						
9								(LSB)
10	Reserved				Access	Except	Rsvd	Full
11	Reserved							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	NotBus	Rsvd	IDValid	LUValid	Rsvd	Logical Unit Number		
15	SCSI Bus Address (same as tape drive's)							
16	Reserved							
17	SValid	Invert	Reserved					
18	(MSB)	Source Element Address						
19								(LSB)
20	Reserved							
21	Reserved							
22	Reserved							
23	Reserved							
24	Density Code of Media (= 0 if empty) (VU)							
25	Unused (VU)							

Figure 8-89 *Data Transfer Element Status Page*

PvolTag and AVolTag are always zero.

Access is always set, and Full is set if a cartridge is in the tape drive.

IDValid and LUValid are always set, drive LUN is 0. The SCSI Bus Address field is the same as the tape drive's controller.

SValid is set if there is a cartridge in the drive, and Source Element Address will indicate which magazine slot it came from.

8.5.3 MODE SENSE/SELECT (1Ah/15h)

All three pages that are specific to Medium Changers are supported.

8.5.3.1 Device Capabilities Page (1Fh)

The drive shall support the Device Capabilities Page which has the following format:

Byte \ Bit	7	6	5	4	3	2	1	0
0	PS	0	Page Code (1Fh)					
1	Additional Page Length (0Eh)							
2	Reserved				StorDT	StorI/E	StorST	StorMT
3	Reserved							
4	Reserved				MT DT	MT I/E	MT ST	MT MT
5	Reserved				ST DT	ST I/E	ST ST	ST MT
6	Reserved				IE DT	IE I/E	IE ST	IE MT
7	Reserved				DT DT	DT I/E	DT ST	DT MT
8	Reserved							
9	Reserved							
10	Reserved							
11	Reserved							
12	Reserved				MT<>DT	MT<>I/E	MT<>ST	MT<>MT
13	Reserved				ST<>DT	ST<>I/E	ST<>ST	ST<>MT
14	Reserved				IE<>DT	IE<>I/E	IE<> T	IE<>MT
15	Reserved				DT<>DT	DT<>I/E	DT<>ST	DT<>MT

Figure 8-90 *Device Capabilities Page Format*

Bit Field Values

- Elements that can store media: StorDT, StorST
- Valid Source->Destination pairs: ST->DT, DT->ST

All the "MT->XX" and the "XX->MT" entries are zero, since the loader will not accept a Medium Transport element address as a source or destination.

All the "IE->XX" and the "XX->IE" entries are zero since there is no Import/Export element.

Bytes 12 through 15 are all zero as the medium changer does not support the exchange medium command.

The medium changer does not support "ST->ST" or "DT->DT".

8.5.3.2 Element Address Assignment Page (1Dh)

The drive shall support the Element Address Assignment Page which has the following format:

Byte \ Bit	7	6	5	4	3	2	1	0
0	PS	0	Page Code (1Dh)					
1	Length (12h)							
2	(MSB)	1st Medium Transport Element Address (01h)						
3								(LSB)
4	(MSB)	Number of Medium Transport Elements (1)						
5								(LSB)
6	(MSB)	1st Storage Element Address (100h)						
7								(LSB)
8	(MSB)	Number of Storage Elements						
9								(LSB)
10	(MSB)	1st Import/Export Elements (0)						
11								(LSB)
12	(MSB)	Number of Import/Export Elements						
13								(LSB)
14	(MSB)	1st Data Transfer Element Address (10)h						
15								(LSB)
16	(MSB)	Number of Data Transfer Elements (01)						
17								(LSB)
18	Reserved							
19	Reserved							

Figure 8-91 *Element Address Assignment Page Format*

Medium Changer Element Address assignment is as follows:

Table 8-12 *Medium Changer Element Addresses*

Address	Comments
0	Default Medium Transport Element
1	Medium Transport Element
2-0Fh	Reserved
10h	Data Transfer Element (tape drive)
11h-0FFh	Reserved
100h	Medium Storage Element (Magazine slot 0)
101h	Medium Storage Element (Magazine slot 1)
102h	Medium Storage Element (Magazine slot 2)
103h	Medium Storage Element (Magazine slot 3)
104h	Medium Storage Element (Magazine slot 4)
105h	Medium Storage Element (Magazine slot 5)
106h	Medium Storage Element (Magazine slot 6)
107h-0FFFFh	Reserved

8.5.3.3 Transport Geometry Parameters Page (1Eh)

The drive shall support the Transport Geometry Page which has the following format:

Byte \ Bit	7	6	5	4	3	2	1	0
0	PS	0	Page Code (1Eh)					
1	Additional Page Length (02h)							
2	Reserved							Rotate
3	Member Number in Transport Element Set (0)							

Figure 8-92 *Transport Geometry Page Format*

Rotation of media is not appropriate for this type of Loader, so the Rotate bit is zero.

There is only one Medium Transport Element, so there is only one set, with one member.

8.5.4 MOVE MEDIUM (A5h)

Byte \ Bit	7	6	5	4	3	2	1	0
0	Operation Code (A5h)							
1	Logical Unit Number			Reserved				
2	(MSB) Transport element Address							
3								(LSB)
4	(MSB) Source Address							
5								(LSB)
6	(MSB) Destination Address							
7								(LSB)
8	Reserved							
9	Reserved							
10	Reserved							
11	Unused		Reserved				Flag	Link

Figure 8-93 *MOVE MEDIUM CDB*

The Move Medium command is used to move cartridges from the tape drive to the magazine slot it came from, or from any magazine slot to the tape drive.

The Transport Element Address field must be zero or one.

Appendix A
Technical Specifications

A.1 In This Appendix

Appendix A contains specifications for the DLT2000 tape drive and the DLT2500/DLT2700 mini-library including:

Topic	Section
Physical Description	A.2
Performance Specifications	A.3
Environmental Specifications	A.4
Vibration and Shock Specifications	A.5
Electromagnetic Interference (EMI) Susceptibility	A.6
Regulatory Requirements	A.7
Drive Reliability Factors	A.8
CompacTape Recording Media Specifications	A.9

A.2 Physical Description

Table A-1 lists the key physical and functional specifications of the DLT2000 tape drive.

Table A-1 *DLT2000 Physical Specifications*

Description	Drive 5 1/4 inch FH (modified depth)	Table Top
Height	82.5 mm (3.25 in) without bezel 86.3 mm (3.4 in) with bezel	146.6 mm (5.77 in)
Width	144.8 mm (5.7 in) behind bezel 148.3 mm (5.84 in) with bezel	235 mm (9.25 in)
Length	228.6 mm (9.0 in) measured from back of front bezel 243.8 mm (9.6 in) including the bezel	332 mm (13.08 in)
Weight	2.9 kg (6 lb, 7 oz)	7.1 kg (15 b, 9.0 oz)
Shipping Weight	3.86 kg (8 lb, 8 oz) depending on configuration	10.85 kg (23 lb) depending on configuration
Environmental temperature		
Operating	10°C to 40°C (50°F to 104°F)	10°C to 40°C (50°F to 104°F)
Nonoperating	-40°C to 66°C (-40°F to 150.8°F)	-40°C to 66°C (-40°F to 150.8°F)
Humidity		
Operating	20% to 80% noncondensing	20% to 80% noncondensing
Nonoperating	10% to 95%	10% to 95%
Certifications		
EMI	Meets VCCi Class 1, CISPR 22 Class A, FCC Class A devices (Class B Verified)	Meets CEmark Class B, VCCi Class 2, CISPR 22 Class B, FCC Class B, FCC ID: (HOM-DLTXX)
Safety	Meets UL, CSA, TUV, "BG" MARK and IEC standards	Meets UL, CSA, TUV, "BG" MARK and IEC standards

Table A-1 *DLT2000 Physical Specifications (cont'd)*

Description	Drive 5 1/4 inch FH (modified depth)	Table Top
Electrical rating, (Auto ranging)	D.C. Supply	100 to 240 Vac
Power Requirements	D.C.	A.C.
	22 W steady state/33 W, maximum	50W, maximum
Power Consumption		
+5 Volt Bus	2.5 A steady state/3.0 A maximum	N/A
+12 Volt Bus	0.8 A steady state/3.0 A maximum	N/A
Communication interface	SCSI-2 bus 8 bits (single-ended or differential) with a separate SCSI LUN ID for the mini-library and tape drive.	SCSI-2 bus 8 bits (single-ended or differential) with a separate SCSI LUN ID for the mini-library and tape drive.
MTBF	80,000 hours	80,000 hours

A.2.1 Identifying the Correct AC Power Cord

Warning

Do not attempt to modify or use an external 100 - 115 VAC power cord for 220 - 240 VAC input power. Modifying the power cord can cause personal injury and severe equipment damage.

An AC power cord was supplied with your unit. Carefully inspect it and make sure that it is the correct one for your country or region based on the criteria listed below. If you feel the supplied AC power cord is not correct, contact your authorized Quantum service representative.

The AC power cord used with this equipment must meet the following criteria:

1. UL and CSA Certified cordage rated for use at 250 VAC with a current rating that is at least 125% of the current rating of the product. In Europe, the cordage must have the <HAR> mark.
2. The AC plug must be terminated in a grounding-type male plug designed for use in your country. It must also have marks showing certification by an agency acceptable in the country.
3. The connector at the product end must be an IEC type CEE-22 female connector.
4. The cord must be no longer than 14.5 feet (4.5 meters).

Note

The power cord should be a minimum of 18/3 AWG, 60°C, Type SJT or SVT.

Figure A-1 shows the different AC power cord plug configurations for 115V and 220V/240V usage.

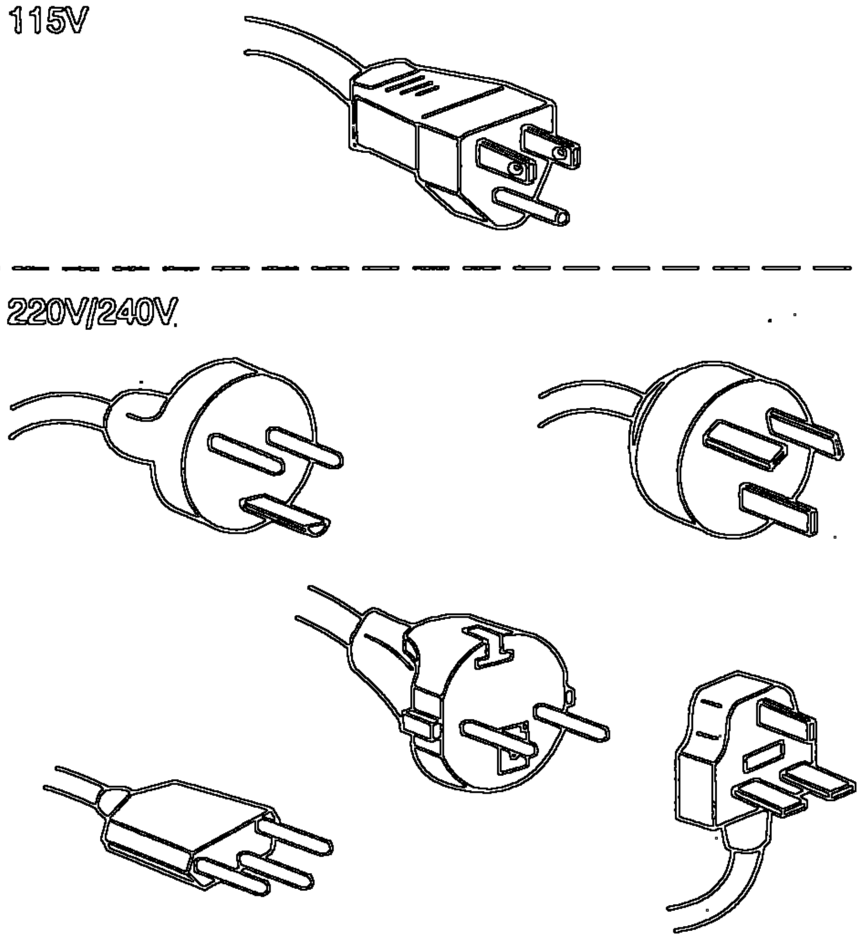

Figure A-1 *Power Cords*

Table A-2 lists the key functional specifications of the DLT2000 tape drive.

Table A-2 *DLT2000 Functional Specifications*

Functions	Specifications
CompacTape III:	
Capacity/formatted native	10.0 GB (standard 1167 ft. tape) user data
Capacity/formatted compressed 2:1[1]	20.0 GB (standard 1167 ft. tape) user data
Interface	8 bit SCSI-2, single ended or differential
Drive Type	DLT, streaming, 10.0/20.0 GB-16 bit, single ended or differential
Recording Type	2-7 RLL code DLT2000 format, MFM with DLT260 and DLT600 formats
Form Factor	5-¼ inch, F.H. modified depth
Transfer Rate, Raw Native	1.7 MBytes/second[2]
Transfer Rate, User Native Uncompressed	1.25 MBytes/second
Transfer Rate, User Compressed[1]	More than 2.5 MB/second maximum write More than 3.0 MB/second maximum read
Error Rate (Recoverable)	1 10 E7 Read recoverable error rate 1 10 E6 Write recoverable error rate
Error Rate (unrecoverable)	2 10 E7 Read interchange recoverable error rate 1 10 E17 Read unrecoverable error rate
Tracks	128; 64 pairs
Linear Bit Density	62,500 bpi/per track

1 Nominal compression ratio. Actual compression is data dependent.
2 Included format data, user data, post amble, and so forth for extended tape.

Table A-3 lists the key physical specifications for the DLT2500 mini-library.

Table A-3 *DLT2500 Mini-Library Physical Specifications*

Description	Rack Mount	Table Top
Height	295 mm (11.6 in)	300 mm (11.8 in)
Width	414 mm (16.3 in)	414 mm (16.3 in)
Length	259 mm (10.2 in)	267 mm (10.5 in)
Weight	12 kg (27 lb)	15.9 kg (35 lb)
Environmental temperature		
Operating	10°C to 40°C (50°F to 104°F)	10°C to 40°C (50°F to 104°F)
Nonoperating	-40°C to 66°C (-40°F to 150.8°F)	-40°C to 66°C (-40°F to 150.8°F)
Humidity		
Operating	20% to 80% noncondensing	20% to 80% noncondensing
Nonoperating	10% to 95%	10% to 95%
Certifications		
EMI	Meets CEmark Class A, VCCi Class 1, CISPR 22 Class A, FCC Class A devices	Meets CEmark Class A, VCCi Class 1, CISPR 22 Class A, FCC Class A devices
Safety	Meets UL, CSA, TUV, "BG" MARK and IEC standards	Meets UL, CSA, TUV, "BG" MARK and IEC standards
Maximum number of cartridges	5	5
Electrical rating (Auto ranging)	100 to 240 V ac	100 to 240 V ac,
AC power requirements	100 W, maximum	100W, maximum
Communication interface	SCSI-2 bus 8 bits (single-ended or differential) with a separate SCSI LUN ID for the mini-library and tape drive.	SCSI-2 bus 8 bits (single-ended or differential) with a separate SCSI LUN ID for the mini-library and tape drive.
Cycle time	20 s, maximum	20 s, maximum

Table A-4 lists the key physical specifications for the DLT2700 mini-library.

Table A-4 *DLT2700 Mini-Library Physical Specifications*

Description	Rack Mount	Table Top
Height	26.47 cm (10.42 in)	27.25 cm (10.73 in)
Width	22.20 cm (8.74 in)	22.54 cm (8.875 in)
Length	68.5 cm (27.0 in)	68.5 cm (27.0 in)
Weight	24.95 kg (55 lb)	29.54 kg (65 lb)
Environmental temperature		
Operating	10°C to 40°C (50°F to 104°F)	10°C to 40°C (50°F to 104°F)
Nonoperating	-40°C to 66°C (-40°F to 150.8°F)	-40°C to 66°C (-40°F to 150.8°F)
Humidity		
Operating	20% to 80% noncondensing	20% to 80% noncondensing
Nonoperating	10% to 95%	10% to 95%
Certifications		
EMI	Meets CEmark Class A, VCCi Class 1, CISPR 22 Class A, FCC Class A devices	Meets CEmark Class A, VCCi Class 1, CISPR 22 Class A, FCC Class A devices
Safety	Meets UL, CSA, TUV, "BG" MARK and IEC standards	Meets UL, CSA, TUV, "BG" MARK and IEC standards
Maximum number of cartridges	7	7
Electrical rating	100 to 120/220 to 240 V ac, 2/1 A Voltage Selection Switch	100 to 120/220 to 240 V ac, 2/1 A Voltage Selection Switch
AC power requirements	82 W, typical 113 W, maximum	82 W, typical 113 W, maximum
Communication interface	SCSI-2 bus 8 bits (single-ended or differential)	SCSI-2 bus 8 bits (single-ended or differential)
Cycle time	50 s, maximum	50 s, maximum

Figure A-2 shows the mounting holes and dimensions in a top view of the DLT2000 drive.

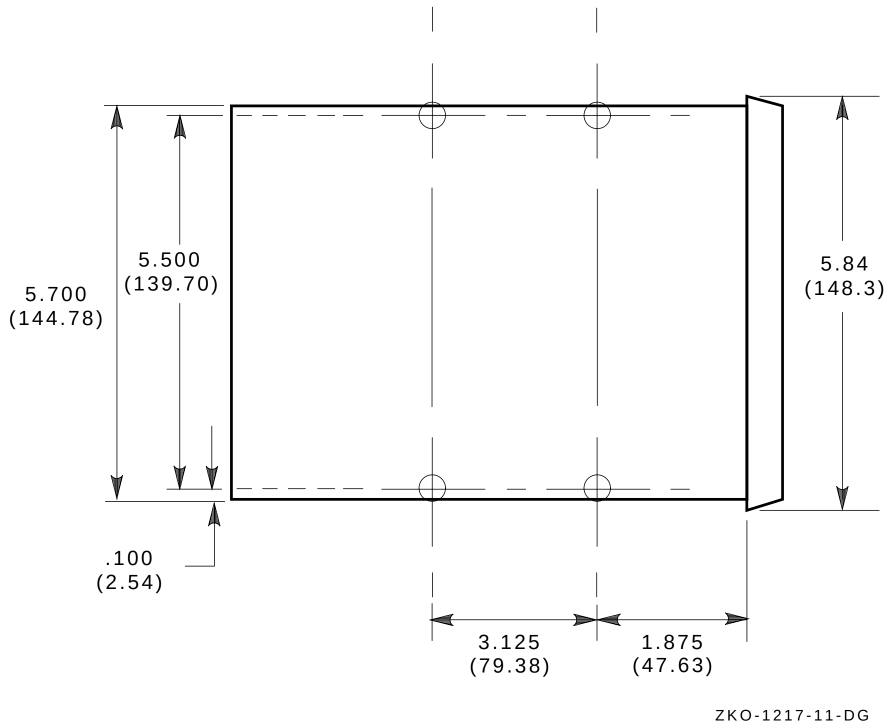

Figure A-2 *Mounting Hole Dimensions (Top View)*

Tape drive width and height are standard 5-1/4 inch disk drive form factor measurements. Both dimensions hold tolerances of ± 0.020 inches. Depth dimensions have tolerances of +00, -0.040 in.

Figure A-3 shows the mounting holes and dimensions in a side view of the DLT2000 drive.

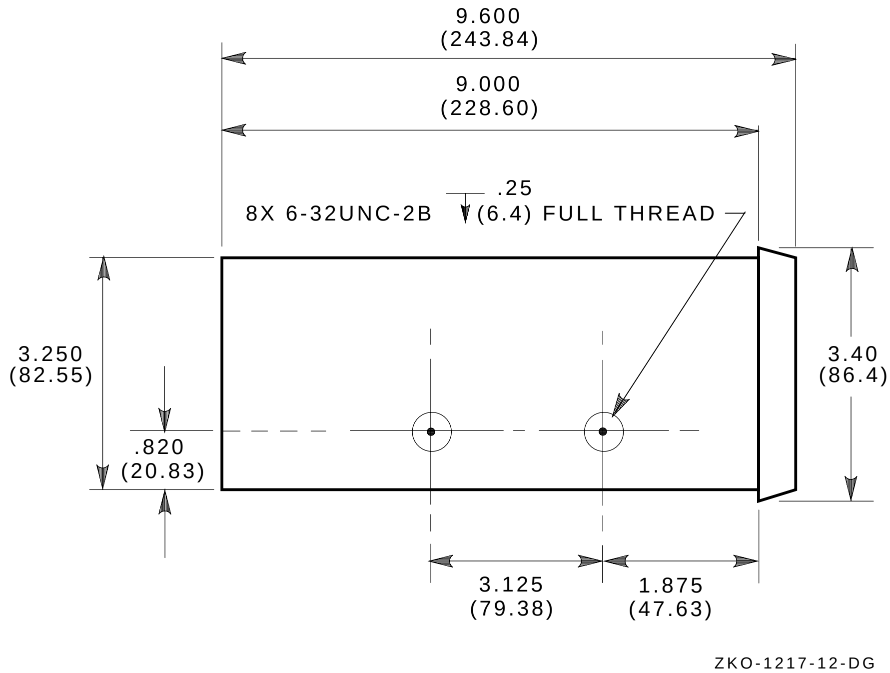

Figure A-3 *Mounting Hole Dimensions (Side View)*

A.3 Performance Specifications

Section A.3 describes performance specifications including:

Topic	**Section**
Nominal Tape Tension	A.3.1
DLT2000 Timing Characteristics	A.3.2
DLT2700 Media Loader Timing Characteristics	A.3.4

A.3.1 Nominal Tape Tension

Nominal tape tension is:

3.0 ± 1 oz when stationary

4.7 ± 1 oz at operating speed

A.3.2 DLT2000 Timing Characteristics

Table A-5 lists timing characteristics of the DLT2000 tape drive:

Table A-5 *DLT2000 Timing Characteristics*

Read/Write Tape speed	110 in/sec
RewindTape speed	150 in/sec search
Linear Search Tape speed	150 in/sec search
Average rewind time	60 sec
Maximum rewind time	120 sec
Average access time (from BOT)	45 sec
Maximum access time (from BOT)	90 sec
Load to BOT—previously written	48 sec; if using a blank tape, time is slightly longer.
Unload from BOT	17 sec

A.3.3 DLT2500xt Media Loader Timing Characteristics

Table A-6 lists timing characteristics of the DLT2500xt media loader.

Table A-6 *DLT2500xt Media Loader Timing Characteristics*

Nominal magazine scan	12.0 sec
Move cartridge slot to drive	11.4 sec
Move cartridge drive to slot	17.1 sec
Error recovery	51.0 sec
Load media on to drive & ready for I/O processing	48.0 sec
Unload media from drive to cartridge (from BOT)	17.0 sec

A.3.4 DLT2700 Media Loader Timing Characteristics

Table A-7 lists timing characteristics of the DLT2700 media loader.

Table A-7 *DLT2700 Media Loader Timing Characteristics*

Nominal magazine scan	12.0 sec
Move cartridge slot to drive	20-30 sec
Move cartridge drive to slot	37.5 sec
Error recovery	30.0 sec
Load media on to drive & ready for I/O processing	48.0 sec
Unload media from drive to cartridge (from BOT)	17.0 sec

A.4 Environmental Specifications

Section A.4 describes environmental specifications including:

Topic	Section
Temperature and Humidity	A.4.1
Altitude	A.4.2

The tape drive conforms to a modified Class B environment that includes general offices and workspaces with:

- Conditioned and marginally-conditioned areas with central or remote air-conditioning
- Complete temperature and humidity controls
- Moderate control tolerances
- Systems capable of maintaining comfort levels (for example, typical offices and general work areas)
- Marginal heating or cooling apparatus
- No humidity conditioning
- Uncontrolled tolerances
- Systems inadequate to maintain constant comfort levels (for example, marginal offices and work spaces)

A.4.1 Temperature and Humidity

Table A-8 lists the operating temperature and humidity ranges.

Table A-8 *Operating Ranges*

Temperature Range	10 to 40°C
Temperature Gradient	11°C/h (across the range)
Temperature Shock	10°C (over two min)
Relative Humidity	20 to 80% noncondensing
Humidity Gradient	10%/h

Table A-9 lists the power-on ranges.

Table A-9 *Power-on Ranges—No Tape Loaded (Unpacked - 72 hours)*

Dry bulb temperature	10 to 40°C
Temperature gradient	15°C/h (across the range)
Temperature shock	15°C (over two min)
Relative humidity	10 to 90%
Humidity gradient	10%/h

Table A-10 lists the storage ranges.

Table A-10 *Storage Ranges (Unpacked or Packed)*

Dry bulb temperature	-40 to 66°C
Temperature gradient	20°C/h with 5° margin (across the range)
Temperature shock	15°C with 5° margin (over two min)
Relative humidity	10 to 95% noncondensing
Humidity gradient	10%/h

Table A-11 lists the shipment ranges:

Table A-11 *Shipment Ranges*

Dry bulb temperature	-40 to 66°C
Temperature gradient	25°C/h with 5° margin (across the range)
Temperature shock	15°C with 5° margin (over two min)
Relative humidity	10 to 95% noncondensing
Humidity gradient	10%/h

A.4.2 Altitude

The tape drive operates in normal pressures from 500 to 30,000 feet.

A.5 Vibration and Shock Specifications

Section A.5 describes environmental specifications:

Topic	**Section**
Operating Shock and Vibration	A.5.1
Nonoperating Shock and Vibration	A.5.2

A.5.1 Operating Shock and Vibration

Table A-12 lists operating vibration specifications and Table A-13 lists operating shock specifications.

Table A-12 *Operating Vibration Specifications*

Vibration type	Sine	Sweep
Frequency range	5–500-5 Hz	Upward and downward sweep
Acceleration level	0.25 g	Between 5 and 22 Hz (crossover)
	0.010" DA	Between 22 and 500 Hz
Application	X, Y, and Z axes	Sweep rate; 1 octave per minute
	Overstress	
Vibration type	Sine	Sweep
Frequency range	5–500-5 Hz	Upward and downward sweep
Acceleration level	0.50 g	Between 5 and 26.1 Hz (crossover)
	0.010" DA	Between 26.1 and 500 Hz
Application	Vertical axis (top/bottom)	Sweep rate; 1 octave per minute

Table A-13 *Operating Shock Specifications*

Pulse shape	1/2 sine pulse
Peak acceleration	10 G
Duration	10 ms
Application	X, Y, and Z axes, once in each axis

A.5.2 Nonoperating Shock and Vibration

Table A-14 lists nonoperating shock (bench handling) specifications for the product without its shipping packaging.

Table A-14 *Nonoperating Shock "Overstress" (Bench Handling - Unpackaged) Specifications*

Test Type	Bench handling; pivot drop
Description	Pivot edge to a height of 4 in above table and release
Application	Four shocks total; once each edge

Tables A-15, A-16, A-17 A-18 and A-19 list nonoperating vibration and nonoperating shock specifications for the product in its shipping packaging.

Table A-15 *Nonoperating (Packaged) Vibration Specifications*

Vibration type	Random vibration	
Frequency range	5 to 300 Hz, vertical (z); 5 to 200 Hz horizontal (x and y)	
Vibration levels	1.19 GRMS overall in vertical (z) axis	
	0.698 GRMS overall in horizontal (x and y) axes	
PSD envelope (vert)	5 to 10 Hz	0.003 g^2/Hz @ 5, to 0.020 @ 10
	10 to 50 Hz	Flat @ 0.020 g^2/Hz
	50 to 300 Hz	0.020 g^2/Hz @ 50 w/ 8 dB/oct rolloff
PSD envelope (horiz)	5 to 10 Hz	0.0011 g^2/Hz @ 5, to 0.007 @ 10
	10 to 50 Hz	Flat @ 0.007 g^2/Hz
	50 to 200 Hz	0.007 g^2/Hz @ 50 w/ 8 dB/oct rolloff
Application	X, Y, and Z axes	One hour, each axis (3 hours total)

Table A-16 *Nonoperating (Packaged) Repetitive Shock Specifications*

Excitation type	Synchronous vertical motion; 1 in excursion
Shock (bounce) cycles	14,200 total
Application	Half cycles each in x and y orientations; 1/2 7100 cycles in the x orientation, 1\2 7100 cycles in the y orientation

Table A-17 *Nonoperating (Packaged) Shock (Drop) Specifications*

Test type	Drop shock
Drop height	30 in - items < 20.9 lbs
	24 in - 21 < items < 40.9 lbs
	18 in - 41 < items < 60.9 lbs
	12 in - 61 < items < 100 lbs
Application	10 drops total; 1 each side, 3 edges, 1 corner

Table A-18 Nonoperating (Unpackaged) Vibration Specifications Nonoperating (Unpackage) Vibration Specifications

Vibration type	Sine	Sweep
Frequency range	5–500-5 Hz	Upward and downward sweep
Acceleration level	1 g	10-500-10 Hz
Application	X, Y, and Z axes	Sweep rate; 1/2 octave per minute
Vibration type	Random	Sweep
Frequency range	10–500 Hz	Upward and downward sweep
Acceleration level	2 g	
PSD envelope		0.008 g^2/Hz.
Application	X, Y, and Z axes	Sweep rate: 60 min/axis

Table A-19 *Nonoperating (Unpackaged) Shock Specifications* Nonoperating (Unpackaged)

Pulse shape	Square wave
Peak acceleration	40 G
Duration	180 in/sec
Application	X, Y, and Z axes, twice in each axis
Pulse shape	1/2 sine pulse
Peak acceleration	140 G
Duration	2 ms
Application	X, Y, and Z axes, twice in each axis

A.6 Electromagnetic Interference (EMI) Susceptibility

Section A. describes electromagnetic interference specifications including:

Topic	Section
Electromagnetic Emissions	A.6.1
Conducted Emissions	A.6.2
Radiated Emissions	A.6.3
Magnetic Radiated Susceptibility	A.6.4
Radiated Susceptibility	A.6.5
Conducted Susceptibility	A.6.6
ESD Failure Level Limits	A.6.7
Acoustic Noise Emissions	A.6.8

A.6.1 Electromagnetic Emissions

Electromagnetic emissions include:

CSA 108.8

EEC Directive 89/336

EN55022 and National standards are based on:

BS6527	(UK)
NEN55022	(Netherlands)
VDE 0871 Class A	(Germany)
CE Mark	
Cispr22 Class A	

- FCC Rules Part 15B
- Class A certified

A.6.2 Conducted Emissions

Limits for Class B equipment are in the frequency range from 0.15 to 30 MHz. The limit decreases linearly with the logarithm of the frequency in the range from 0.15 to 0.50 Mhz.

Table A-20 list the conducted emission limits.

Table A-20 *Conducted Emissions*

Frequency Range (MHz)	Limits dB	
	Quasi-peak	Average
0.15 to 0.050	66 to 56*	56 to 46
0.50 to 5	56	46
5 to 30	60	50

*The limit decreases with the logarithm of the frequency.

A.6.3 Radiated Emissions

Limits of radiated interference field strength, in the frequency range from 30 MHz to 30 GHz at a test distance of 3 and 10 meters, for Class B equipment are listed in table A-21.

Table A-21 *Radiated Emissions, 30 Mhz to 30 Ghz*

Frequency range (MHz)	Quasi-peak limit dB (μV/m)	
	@ 10 m	@ 3 m
30 to 230	30	40
230 to 1000	37	46
Above 1000	N/A	54

A.6.4 Magnetic Radiated Susceptibility

Table A-22 lists the magnetic radiated susceptibility limits.

Table A-22 *Low Frequency, Magnetic Fields, 10 to 3000 kHz*

100 dB (pt) @ 10 kHz declining to 80 dB (pt) @ 1 MHz	No errors, no screen distortion

A.6.5 Radiated Susceptibility

Table A-23 lists the radiated susceptibility limits:

Table A-23 *High Frequency, Electric Fields, 1 to 1000 Mhz*

3 V/m (rms) 80% modulated 1 kHz	No errors, no screen distortion S/W recoverable errors No hardware failure

A.6.6 Conducted Susceptibility

The transient voltage is the actual peak voltage above the normal ac voltage from the power source.

Table A-24 lists the voltage limits for power and data cables:

Table A-24 *Fast Transient (Bursts) for Power and Data Cables*

2 kV	S/W recoverable errors No hardware failures

Table A-25 lists power cable voltage limits:

Table A-25 *High Energy Transient Voltage for Power Cables*

1.2 kV	No errors
2.5 kV	S/W recoverable errors No hardware failure

Note

Maximum energy in a single pulse from the transient generator must be limited to 2.5 W.

Table A-26 lists the low-level conducted interference voltage limits:

Table A-26 *Low-level Conducted Interference*

3 V(rms) 80% modulated 1 kHz	No errors S/W recoverable errors No hardware failure

A.6.7 ESD Failure Level Limits

Table A-27 lists the ESD failure level limits for normal operator access areas.

Table A-27 *ESD Failure Level Limits*

Failure Type	Equipment	Failure Level	Allowable Errors
Hard	Office	1 to 12 kV	No operator intervention (soft recoverable allowed)
Hardware	Office	Up to 15 kV	No component damage (soft/hard errors allowed)

A.6.8 Acoustic Noise Emissions

The following lists the acoustic noise emission levels:

Table A-28 *Acoustic Noise Emissions, Nominal*

Noise Power Emission Level (LNPEc)			
Mode	**DLT2000 Drive**	**DLT2000 Tabletop**	**DLT2700 Loader**
Idle	N/A	4.3 bels	5.1 bels
Streaming	N/A	4.9 bels	5.2 bels

Sound Pressure Level (LPAc)			
Mode	**DLT2000 Drive**	**DLT2000 Tabletop**	**DLT2700 Loader**
Idle	N/A	35.0 dB	34.0 dB
Streaming	N/A	40.0 dB	35.0 dB

Table A-28 *Acoustic Noise Declaration for German Noise Declaration Law* Cont'd

Schallemissionswerte - Werteangaben nach ISO 9296 und ISO 7779/DIN EN27779:				
	Schalleistungspegel LwAd, B		Schalldruckpegel LpAm, dBA (Zuschauerpositionen)	
Gerät	**Leerlauf**	**Betrieb**	**Leerlauf**	**Betrieb**
TH3xx		5,5		45
TH3Bx	5,2	5,3	39	40
TH3Ex	5,5	5,6	33	33
TH3Fx	5,5	5,6	33	33

Table A-28 *Acoustic Noise Declaration for German Noise Declaration Law (*Cont'd)

Generic Product Option Numbers	Description
TH3xx	DLT2000 drive
TH3Bx	DLT2000 table top drive
TH3Ex	DLT2700 cartridge rackmount loader
TH3Fx	DLT2700 cartridge table top loader

A.7 Regulatory Requirements

Regulatory requirements include:

- Safety
- Electromagnetic emissions

A.7.1 Safety Requirements

Safety requirements include:

- UL1950 - Information Technology Including Electrical Business Equipment
- CSA C22.2 #220 - Information Technology Including Electrical Business Equipment
- TUV EN60950 - Information Technology Including Electrical Business Equipment

A.7.2 Electromagnetic Emission Requirements

Electromagnetic emission requirements include:

FCC, Part 15, Class A
EN55022/A
EN55082/A
CISPR22/A
VCCi/ Class 1 and 2
CEmark Class A

A.8 Drive Reliability Factors

Table A-29 lists the reliability factors:

Table A-29 *Reliability Factors*

Design life	Seven years	Design life statistics provide the point at which statistical failure rate begins to rise.
Head life	10,000 tape motion hours	Continuous operation, under severe stress envelope with CompacTape media.
MTBF	80,000 hours	Quantum Corporation does not warrant that predicted MTBF is representative of any particular unit installed for customer use. Actual figures vary from unit to unit.
Tape life	500,000 passes	

A.9 CompacTape Recording Media Specifications

Table A-30 lists the media characteristics:

Table A-30 *CompacTape Recording Media Specifications*

CompacTape III Description	Quantity
Width	0.5 in metal particle
Length	1200 ft
Cartridge Dimensions	4.1 in x 4.1 in x 1.0 in
Shelf Life	30 years min. @ 20°C & 40% RH (non-condensing)
Usage	500,000 passes

Appendix B

Definition of Vendor Unique Sense Data Information

B.1 In This Appendix

Appendix B lists the internal status codes with their descriptions.

B.2 Internal Status Code

The internal status code is located at byte offset 18 of the request sense data and may be available after certain types of failures.

Note

This byte has two formats: a byte code, and a bit flags format. The bit flags format is used when there is no internal status code to report, and can be distinguished by bit 7 being set.

Table B-1 *Internal Status Code*

Dec	Hex	Description
0	0	No meaning
1	1	Reed-Solomon Error Correction Code recovery
2	2	Read or write block retry (soft retry)
3	3	Reposition command aborted
4	4	Controller has stopped reading
5	5	No control or data buffers available
6	6	Target delivered in read ahead

Table B-1 *Internal Status Code (cont'd)*

Dec	Hex	Description
7	7	Logical EOT encountered, 2 file marks
8	8	Command connection dropped
9	9	Cleared from queue
10	0A	Missing data block—read only
11	0B	Gap within object (missing blocks in record)
12	0C	Record on tape larger than requested
13	0D	Compare error
14	0E	Successive blocks missing across objects
15	0F	Drive state not valid for command
16	10	Drive error
17	11	Drive communication timeout error
18	12	Drive unloaded
19	13	Unable to write - no CRC
20	14	Block to append to not found
21	15	Data synchronization error (read after write not happening)
22	16	Missing block(s) in current entity
23	17	Drive hardware write protected
24	18	Reposition-target not found
25	19	Long gap encountered (blank tape or no data encountered)
26	1A	End of data or filler block encountered
27	1B	File mark encountered
28	1C	EDC error found by GPSP3 - FECC RAM bad
29	1D	Beginning of medium encountered
30	1E	EDC error
31	1F	Hard write error - GPSP3 Underrun
32	20	Hard write error - Read Sync Timeout
33	21	Hard write error - Overshoot Append
34	22	Hard write error - CRC error
35	23	EDC error found by GPSP3 - FECC RAM ok
36	24	Timeout on command to medium changer
37	25	Medium changer UART error (overrun)
38	26	Medium changer response length error
39	27	Medium changer detected error

Table B-1 *Internal Status Code (cont'd)*

Dec	Hex	Description
40	28	Invalid source slot
41	29	Invalid destination slot
42	2A	Source slot empty
43	2B	Destination slot full
44	2C	Medium changer motion error
45	2D	Medium changer/drive interface error
46	2E	Medium changer/slot interface error
47	2F	Medium changer mechanical error
48	30	Medium changer hardware error
49	31	Medium changer controller error
50	32	Unrecognized medium changer subcommand
51	33	Medium changer fatal error
52	34	Medium changer is in manual mode
53	35	68020 detected communication error w/ Servo area
54	36	68020 detected drive command timeout
55	37	Calibration failure
56	38	Bad tape format

Table B-2 *Internal Status Bit Flags*

Bit No.	Description
0	If set, cleaning light is on, otherwise it is off
1-2	Tape directory status: • 0 Good status • 1 Unknown status • 2 Directory partially bad • 3 Directory bad
3-6	Reserved
7	If set, the internal status byte (18) is in Bit Flags format; otherwise, it is a code.

Appendix C

Sense Key Information

C.1 In This Appendix

Appendix C lists the sense key information.

- No Sense (0):

  00 01 Unexpected FM encountered

  00 02 EOM encountered

  00 04 BOM encountered

- Recovered Error (1):

  0A 00 Error Log Overflow

  37 00 Rounded Parameter

  3B 08 Repositioning error

  44 C1 Internal Target failure, EEROM copy 1 area bad

  44 C2 Internal Target failure, EEROM copy 2 area bad

  44 C3 Internal Target failure, EEROM both copy areas bad

  47 00 SCSI Parity Error

  48 00 IDE Message Received

  51 00 Erase failure

  53 01 Unload tape failure

  5B 02 Log Counter at Maximum

  80 02 Cleaning Requested

- Not Ready (2):

  04 00 Unit Not Ready, Cause nonreportable

  04 01 Unit Not Ready, Calibration in process

04 02 Unit Not Ready, Load command needed

04 03 Unit Not Ready, Manual Intervention needed

3A 00 Medium Not Present

3A 80 Medium Not Present, Cartridge Missing

5A 01 Operator Media Removal Request

- Medium Error (3):

04 02 Unit Not Ready, Load command needed

0C 00 Write Error

11 00 Unrecovered Read Error

11 08 Unrecovered Read Error, Incomplete block read

14 00 Recorded Entity Not Found

15 02 Position error detected by read of medium

30 00 Can't Read Medium

3B 00 Sequential positioning error

3B 08 Repositioning error

51 00 Erase Failure

80 00 Calibration Error

80 01 Cleaning Required

81 00 Directory Read Error

- Hardware Error (4):

08 00 LUN Communication Failure

08 01 LUN Communication Timeout Failure

15 01 Random Mechanical Positioning Error

21 01 Invalid Element Address

3B 08 Repositioning error

3B 0D Media Destination Element Full

3B 0E Media Source Element Empty

40 80 Diagnostic/POST failure, ROM EDC failure

40 81 Diagnostic/POST failure, RAM failure

40 82 Diagnostic/POST failure, bad drive status

40 83 Diagnostic/POST failure, loader diags failure

40 84 Diagnostic/POST failure, POST soft failure

44 00 Internal Target Failure

44 80 Unexpected selection interrupt

44 83 SCSI chip gross error

44 84 Unexplained residue in TC registers

44 85 Immediate data transfer timeout

44 86 Insufficient CDB bytes

44 87 Disconnect/SDP sequence failed

44 88 Bus DMA transfer timeout

48 00 IDE Message received

47 00 SCSI Parity Error

51 00 Erase Failure

53 00 Media Load/Eject Failure

53 01 Unload tape failure

- Illegal Request (5):

1A 00 Parameter List Length Error

20 00 Illegal Opcode

21 01 Invalid Element Address

24 00 Invalid CDB Field

24 81 Invalid mode on write buffer

24 82 Media in drive

24 84 Insufficient resources

24 86 Invalid offset

24 87 Invalid size

24 89 Image data over limit

24 8B Image/personality is bad

24 8C Not immediate command

24 8D Bad drive/server image EDC

24 8E Invalid personality for code update

24 8F Bad controller image EDC

25 00 Illegal LUN

26 00 Parameter List Error, invalid field

26 01 Parameter List Error, parameter not supported

26 02 Parameter List Error, parameter value invalid

39 00 Saving parameters not supported

3B 0D Media Destination Element Full

3B 0E Media Source Element Empty

3D 00 Invalid Bits in ID Message

53 02 Media Removal Prevented

82 00 Not allowed if not at BOT

- Unit Attention (6):

28 00 Not Ready To Ready Transition

29 00 Reset occurred

2A 01 Mode Parameters changed

2A 02 Log Parameters changed

3F 01 Microcode has been changed

5B 01 Log Threshold condition met

- Data Protected (7):

27 80 Hardware Write Protect

27 82 Data Safety Write Protect

- Blank Check (8):

00 05 EOD Encountered

- Command Aborted (Bh):

43 00 Message error

44 82 Command Complete sequence failure

45 00 Select/Reselect Failure

47 00 SCSI parity error

48 00 IDE Message received

49 00 Invalid Message Error

4E 00 Overlapped commands attempted

- Volume Overflow (Dh):

  no additional sense code

- Miscompare (Eh):

  no additional sense code

Note

The Filemark/EOM/ILI bits may be set even though ASC/ASCQ = 00 00:

(1) FM, EOM, ILI bit may be set with no sense key (0) and ASC/ASCQ = 00 00

(2) FM, EOM, ILI bit may be set with recovered error (1) and ASC/ASCQ = 00 00

(3) FM, EOM, ILI bit may be set with medium error (3) and ASC/ASCQ = 00 00

(4) EOM bit is set at Volume Overflow (Dh) and ASC/ASCQ = 00 00

(5) FM (byte 2, bit 7), EOM (byte 2, bit 6), and ILI (byte 2, bit 5) are fields in request data. (See figure on REQUEST SENSE Data.)

Appendix D

EEROM Resident Bugcheck and Event Logs

D.1 EEROM Packets (Last n Error Events)

The DLT2000 products keep certain error and event logs in semi-permanent non-volatile memory (EEROM) on the ECM. There is room for a total of 14 such information packets in EEROM, each consisting of 98 bytes (96 data bytes plus 2 control bytes) of information. Packets can be written for many different reasons, and several packet types exist, but each must conform to the standard EEROM LOG packet envelope as shown in Figure D-1.

The information logs are maintained as a circular buffer; a new entry will overwrite the oldest existing entry. At any point in time, the most recent 14 logs are kept.

The EEROM information packets can be retrieved by Log Sense command with page code 07h ((Last n Error Events page).

The packet type field defines the content as well as the format of the data portion of the packet (refer to Table D-1). These packet types are further delineated in the sections that follow. Please note that the byte offsets in the structure layout diagrams that follow are referenced relative to the beginning of the 98 byte EEROM Log envelope.

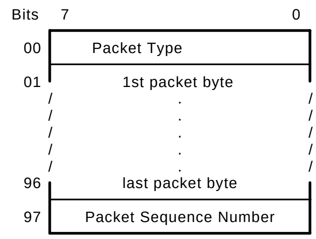

Figure D-1 *EEROM Log Area Layout*

Table D-1 *EEROM LOG Packet Types*

Packet Type	Purpose
0	Packet Empty
1	Bugcheck - Fatal System Crash
2	PO/ST (power on/self test) Failure
3	EVENT LOG - Generic event informational (non-fatal) data
4	CUP - Code Update Status Packet
5	Manufacturing DIAG results packet

D.2 Bugcheck Packets

Bugchecks occur because of some kind of software detected fatal failure. For example, a hardware failure, or an internal system consistancy failure might cause a bugcheck. These events cause Bugcheck packets to be written into EEROM. Refer to Figure D-2 for the detailed packet layout. The most important information is the error code. The more common ones are listed in Table D-2. A full listing is not given here because most are not meaningful without a detailed knowledge of the firmware design. Analysis of the other informtion saved in an EEROM Bugcheck log entry also requires in-dpth internal firmware knowledge to interpret and attempt to determine if the cause was external (e.g. a bad SCSI bus cable, improper termination, etc.), an ECM or drive fault, or a firmware bug.

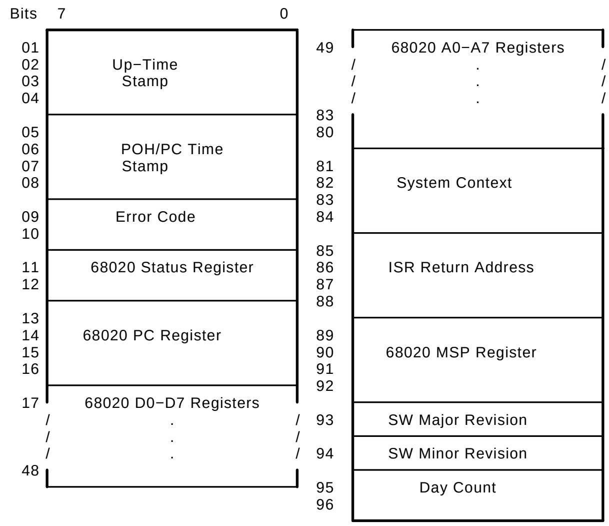

Figure D-2 *Bugcheck LOG Packet Layout*

Table D-2 *Bugcheck Error Codes*

Bugcheck Code	**Meaning and Possible Cause**
E204	nexpected Timer2 Interrupt- possible ECM fault
EE01	Spurious Non-Maskable Interrupt- possible ECM fault
EE02	Spurious 8254 Timer Interrupt- possible ECM fault
EE03	Spurious Level 5 interrupt (GPSP)- possible ECM fault
EE04	Spurious Drive Comm Interrupt- possible ECM fault
EE05	Spurious Loader Comm Interrupt- possible ECM fault
EE06	Spurious Diag Comm Interrupt- possible ECM fault
EE08	Watch Dog Expiration- SCSI bus may have lost termination, or ECM is constantly receiving non-tape commands.
EE09	Spurious Power Fail Signal received- possible power supply fault
EE0D	Spurious Level 6 interrupt (GPSP)- possible ECM fault
F202	Loader time out-possible media loader fault

D.3 PO/ST failure packets

PO/ST failure packets are stored whenever the Power-On /Self-Test logic detects a failure of any kind. Each failure is encoded as a 4-byte vector. In some cases, multiple vectors may be stored, as shown in Figure D-3.

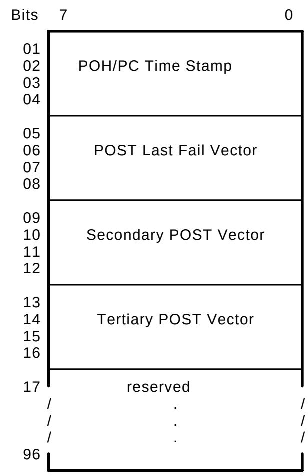

Figure D-3 *POST LOG Packet Layout*

D.4 Event Log packets

Event logs are non fatal and can occur to log error or informative information regarding significant events. The general envelope for these packets is shown in Figure D-4. Refer to Table D-3 for a list of the existing error codes, as well as where to refer for additional information.

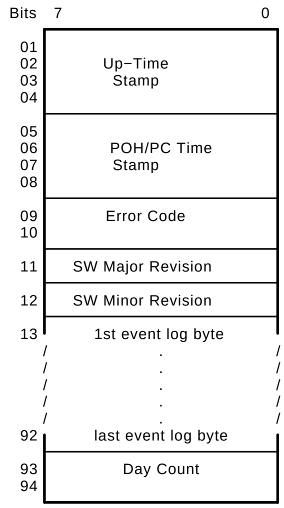

Figure D-4 *EVENT LOG Packet Layout*

Table D-3 *Event Log Codes*

Event Log Code	Meaning
0xA400	Hard Read Error Log
0xA401	Hard Write Error Log
0xA402	Drive Error Log
0xA403	Loader Error Log
0xA407	Directory Read Fail
0xA408	Directory Write Fail

D.4.1 Directory Failure Event Logs

These event logs are written when a directory read or write request fails for any reason. Refer to Figure D-5 and the sections that follow.

Bits	7 0
13	Saved Max Overwrites
14	Saved Max ReReads
15	Saved Max ReWrites
16	Dir Called Mode
17 18	Tape Format (when called)
19 20	New Tape Format
21	Flags
22	Primary Status
23	Secondary Status
24	reserved
25	Missing Block Count
26	Total Expected LBNs
27 28	Servo EOT Address
29 30 31 32	Unique Media ID
33 34 35 36	CR−MSG Buffer Address

Figure D-5 *Directory Failure Event Logs*

Saved Overwrites/ReReads/ReWrites

These are fields are used as temporaries and have no use in interpreting these packets.

Dir Called Mode

A code which specifies the original reason for the directory call. A value of 1 indicates a directory READ (on load); a value of 2 indicates a directory WRITE (on UNLOAD); a value of 3 indicates a directory WRITE (on WRITE from BOT).

Tape Format (Called/New)

These fields contain the TMSCP values for the tape format both prior to and after the directory operation.

Flags

A bit mapped field which provides additional status information. Refer to Table D-4.

Table D-4 *SET DIR_TAB "Directory Event Log Flags*

Bit Mask	Meaning

0x01	READ on Load operation complete
0x02	Inhibit further WRITEs unless WRITE from BOT
0x04	LBN 0 was found intact
0x08	Directory WRITE failed
0x10	Tape FORMAT Mismatch
0x20	Event Log Generated
0x40	Tape Format Unknown
0x80	Reserved

D.5 Primary Status/Secondary Status

Table D-5 *Directory Event Statuses*

Primary	Secondary	Meaning
0	0	Status Unknown
1	1	No Directory - 50/70 Format
1	10	Inconsistent Formats
1	11	Wrong Format
1	12	Reserved Field Validation Failed
1	20	Read Sync Time Out
1	21	No directory Blocks Read
1	22	Not all Directory Blocks Present
1	30	SyncLock Failure
1	31	Revision Level Mismatch
1	32	Directory Verify Failed
1	33	Directory Initialized (WRITE from BOT)
1	40	Empty Directory
2	41	Partial Directory
3	42	Complete_Directory

Missing Block Count

The number of missing directory LBNs.

Expected LBNs

The total number of directory LBNs expected.

Servo EOT Address

Servo version of tape length.

Unique Media ID

The Unique Media Identification number, stored on the media.

CR_MSG Address

The address of the CR-MSG request block from TDS.

D.6 Code Update (CUP) Status Packet

The CUP status packet is written after every code update attempt regardless of its status. Refer to Figure D-6 for the overall packet layout.

The "Old 68020" and "Old Servo" Sections contain informa- tion about the code images that exist in the Flash memories for those areas before the update is performed. The "New 68020" and "New Servo" sections contain information about the new images. The fields within these sections are self explanatory. Refer to Table D-6 and Table D-7 for a description of the statuses.

Bits	7 0		
01 02 03 04	POH/PC Time Stamp		
05	68020 Fw Update Status		
06	Servo Fw Update Status		
07 08	reserved		
09	Old 68020 Code Version	33	New 68020 Code Version
10	Old 68020 Code Sub−revision	34	New 68020 Code SubRev
11	Old 68020 Rel Flag	35	New 68020 Rel Flag
12	reserved	36	reserved
13 14 15 16	Old 68020 Code EDC value	37 38 39 40	New 68020 Code EDC value
17 18 19 20 21 22 23 24	Old 68020 Code Time Stamp	41 42 43 44 45 46 47 48	New 68020 Code Time Stamp
25	Old 68020 Code Pers	49	New 68020 Code Pers
26	Old 68020 Code Pers SubRev	50	New 68020 Code Pers SubRev
27 28	reserved	51 52	reserved
29	Old Servo Code Version	53	New Servo Code Version
30	reserved	54	reserved
31 32	Old Servo Code EDC value	55 56	New Servo Code EDC value

Figure D-6 *Code Update (CUP) LOG Packet Layou*

Table D-6 *68020 Code Update Status*

Status	Meaning
0	No Update Operation Performed
1	Code Update Operation Successful
50	Personality Lockout
51	Image EDC Check Failed
52	Bad Image
53	Write to FLASH Memory Failed
54	Erase of FLASH Memory Failed
55	FLASH Memory Clear (zero) Failed
56	Invalid Image Compressed)

Table D-7 *Servo Code Update Status*

Status	Meaning
0	No Update Operation Performed
1	Code Update Operation Successful
2	Servo Update Not Necessary
10	Servo Code Update Inhibited
20	Servo Image Validation Failed
21	Bad Initial Poll
22	Servo Family Mismatch
23	Servo FLASH Erase Failed
24	Erase Time Out
25	Image Transmit Failed
26	Bad Final Poll
27	Invalid Final Code Check
28	BOT Time Out
29	Invalid_Lamp_Status

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